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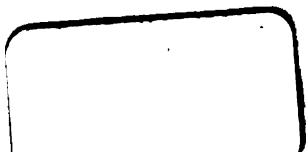


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GEORGIA  
State Board of Entomology

BULLETIN No. 23.—FEBRUARY 1922

The APPLE WOOLLY

AND

REMEDIAL MEASURES

This bulletin contains a report on experiments  
in 1905 and 1906.

GREEN APPLE LEAF APHIS AND

BY

R. L. SMITH, State Entomologist



ENTOMOLOGICAL  
BUILDING

Atlanta

$$\begin{aligned} (p(A) + q) &= 1 \\ \text{or } p(A) &= 1 - q(A) \end{aligned}$$

# GEORGIA State Board of Entomology

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BULLETIN No. 23.—FEBRUARY, 1907.

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This bulletin contains a report on experiments conducted  
in 1905 and 1906.

## GREEN APPLE LEAF APHIS AND REMEDIES

BY  
R. I. SMITH, State Entomologist.



CAPITOL  
BUILDING

Atlanta, Ga.

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1907.

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## ACKNOWLEDGMENTS.

The writer desires to acknowledge the valuable work performed by Harper Dean, Jr., former Field Assistant—who is now Asst. Entomologist for the Vir. Crop Pest Comm.—in conducting the experimental work against woolly aphis at Morrow in 1905, and also the work of Mr. W. V. Reed, our present Field Assistant, in conducting the 1906 experiments,—reported herein,—at Cornelia and Baldwin, Ga. Much of the work performed by the above named gentlemen was both disagreeable and tedious, it being necessary for them to make most of the experiments in person. Without their sincere interest and attention to the work the experiments conducted would probably have been much less valuable.

For orchards in which to conduct the woolly aphis experiments the writer and the State Board of Entomology, are indebted to Mr. J. C. H. Sneed of Morrow, Mr. S. R. Christie and Col. O. B. Stevens of Cornelia, and Mr. Ethan Philbrick of Baldwin. These gentlemen kindly allowed the experiments to be conducted on their apple trees, and in addition they offered material assistance in various ways. The writer extends most cordial thanks to these gentlemen for the use of their orchards and for the many courtesies shown himself and his assistants during the time the experiments were being conducted.

For the privilege of reproducing certain illustrations, used in this bulletin and which add greatly to its value, we extend our thanks to those whose names are mentioned under the respective illustrations.

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# BULLETIN

OF THE

## Georgia State Board of Entomology.

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*FEBRUARY, 1907.*

*No. 23.*

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Published by the Georgia State Board of Entomology, Atlanta, Ga., and sent free of charge to all residents of the State who make request for same.

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### APPLE WOOLLY APHIS AND REMEDIAL MEASURES.

#### Summary and Recommendations.

Commencing on page 31 the reader will find a brief account of the woolly aphis, its appearance, habits, life history, and nature of injury inflicted. Without a fairly correct knowledge of these facts, concerning the insect and its work, the reader might not fully appreciate the importance and significance of the remedial recommendations.

The woolly aphis occurs in two forms, one attacking the trunk or limbs in cracks and bruised places, and the other occurring on the roots. Its presence in either place is indicated by cottony masses, bluish-white in appearance, under which, by a close examination, preferably with a magnifying glass, the brownish bodies of the lice may be detected. The whitish cottony substance is merely a secretion from the bodies and serves as a protection for the insects.

By feeding on the roots the insects cause abnormal swelling or galls, the tissue of which soon dies, so that the roots are destroyed. The result to the trees from this injury is seen in a yellowish, scanty foliage, a general sickly appearance, a dwarfed growth, and sometimes when the main roots are nearly destroyed the trees may be blown over by a high wind.

The aerial form, or the one occurring on the trunk and limbs, is easily detected because of the white, cottony covering. They will usually be found in small masses in some abrasion of the bark.

This bulletin contains a report on the result of experiments with remedies for the root infesting form of woolly aphis. Several remedies have been carefully tested and from the result of the past two years' work we are enabled to recommend a remedy that will, we think, prove both practicable and effective.

Briefly summarized, the report in the following pages indicates the following:

That, Kerosene emulsion, at 15 per cent strength, may be recommended as a direct remedy for the root form of woolly aphis. For particulars concerning the method of applying, the amount to use, etc., see page 27. Kerosene emulsion has proved to kill all the aphis on the roots in the area over which the emulsion has been applied.

That, Tobacco dust and kainit, mixed in equal parts, when applied at the rate of 6 to 10 pounds per tree, will kill a small per cent. of the aphid, provided the mixture be applied at least twice during the summer. Directions for applying found on page 18.

That, Tobacco stems are about as valuable as the mixture of tobacco dust and kainit, provided the stems are used in considerable quantities, and applied frequently.

That, Carbon bi-sulphide proved to kill woolly aphid over a limited area around the opening in which the liquid was placed. It cannot, however, be used in sufficient quantities, to kill all the aphid without at the same time killing or injuring the trees.

That, in one experiment common salt appeared to kill all the aphid, but it is feared that the same result might not follow in every instance.

That, Whale oil soap solution, tested at strengths varying from  $\frac{1}{2}$  to 2 pounds of soap per gallon of water, applied the same as kerosene emulsion, has been used without success.

That, Kainit alone, applied at the rate of eight pounds per tree is of no value against the woolly aphid.

The last portion of this bulletin is devoted to a short account of the apple leaf aphid which appears in spring or summer on the buds and leaves, causing the latter to curl, turn black and die. Young apple trees and apple nursery stock are often injured quite severely by the leaf aphid, the trees often being severely dwarfed in growth.

Apple leaf aphid may be controlled by spraying with a tobacco decoction made by boiling three pounds of tobacco stems for two hours, in five gallons of water. Or by kerosene emulsion at 20 per cent. strength. The former is most highly recommended. Nursery stock may be treated by bending the tops over and dipping in a bucket of tobacco decoction.

### CAUTIONS.

Kerosene emulsion must be used with proper caution, taking care to have the emulsion properly prepared, and applied during spring or summer. It should not be applied to apple tree roots later than the last of July. The reason why this precaution is recommended is because it is feared that the kerosene may injure trees when in a semi-dormant condition. After July trees are liable to stop growing, especially where cultivation is not kept up. We advise against the use of kerosene emulsion at any time during winter, or before the first of March, which is about the time the trees usually commence to grow.

Experience with oil treatment on peach trees for the control of the San Jose scale, has shown that the oil is more liable to injure the trees in winter than in summer. It is believed, and with good reason, that when trees are full of sap, and in a vigorous growing condition, the oil does not penetrate enough to cause injury. On the other hand, when the trees are dormant the oil may penetrate through the bark and kill the trees. It is largely for this reason that we caution apple growers against attempting to apply kerosene emulsion to the roots of apple trees during winter. Furthermore, the woolly aphid should be killed in spring just as they are commencing to breed in order to avoid their increase to injurious numbers.

# WOOLLY APHIS OF APPLES AND REMEDIAL MEASURES.

*With Particular Reference to the Destruction of the  
"Root" form.*

BY R. I. SMITH.

## INTRODUCTION.

Georgia fruit growers, especially in the northern portion of the State, are beginning to realize the value of apples as a staple market product. This increase in the interest taken in apple growing has caused the State Board of Entomology to receive many letters asking for information about the control of apple insects. The inquiries have been varied in their nature, but a large per cent. ask for a remedy for the apple woolly aphis. In fact, so many letters have been received, and up to last year our actual experience with remedies for the pest had been so meagre, that it seemed advisable to attempt to learn the best remedy for this insect. Accordingly experiments were planned to cover the years 1905 and 1906. These experiments have now been completed, with, we are happy to say, pleasing results. That is, the results were pleasing in that we think we have demonstrated the value of kerosene emulsion, as a direct remedy, and furthermore, we have learned that the recommendation commonly made, that of using tobacco dust—as a direct remedy—is not as valuable as has generally been supposed. In this bulletin an attempt will be made to show exactly what results were secured from the experiments referred to, and to give in addition a fairly full description of the woolly aphis and the nature of the injury it inflicts to apple trees, in order that persons reading the bulletin may go out and determine by their own examination if their trees are attacked by this pernicious pest. The writer wishes to state that this bulletin is being prepared for the use of the orchardist whose knowledge of injurious insects may be very meagre, as well as for those who have had more or less experience in this work. A description of the life his-

tory and habits of the woolly aphis follows the report on experiments. Readers who are not thoroughly familiar with the habits of the insect may find it greatly to their advantage to study this portion of the bulletin (pages 31 to 40), as then they will more easily understand the remedial suggestions.

#### **Extent of Injury Caused by the Aphis.**

According to the best information obtainable at the present writing the apple orchards of Georgia contain something over 2,000,000 trees of all ages. From a general knowledge of the distribution of the woolly aphis the writer is inclined to believe that at least half of the apple trees in the state are infested by this pest. Of the trees infested it is surely safe to estimate that their value is decreased 15 per cent. by the attacks of the woolly aphis. Allowing that 1,000,000 trees in the state are attacked by the aphis, and supposing that each tree, if in first class condition, would be worth \$1.00—which is a very low estimate—it is a simple matter to estimate that the 15 per cent. damage caused by the woolly aphis amounts to \$150,000. This may sound like an enormous figure, but a careful survey of the apple orchards of the state would undoubtedly justify the statement. So much of the damage caused by woolly aphis is unnoticed and unsuspected that at first thought the above statement may seem unreasonable. But let every individual who has apple trees, examine into conditions and then consider that nearly every one has a few trees, and it may after all appear that the loss occasioned by this insect is not over-estimated.

The nurserymen suffer greatly through loss of trees infested by the woolly aphis. Under the present nursery inspection law of Georgia all nursery trees visibly affected by the woolly aphis must be discarded and burned when dug. While inspecting nurseries during the last four years the writer has had ample opportunity to observe the damage from woolly aphis in the nurseries, and undoubtedly this loss is greater than is generally supposed. Even the nurserymen themselves probably do not realize how much their trees are damaged, or at least weakened, by the attack of this insect.

#### **Object of this Publication.**

In October, 1904, a bulletin was published by the Board, Bulletin No. 13, "Some Common Apple Insects," in which

the woolly aphis was mentioned together with remedial measures. In that bulletin it was recommended to use tobacco dust as a direct remedy for infested apple trees. The experiments recorded in this bulletin will show conclusively that our former recommendations—based mainly on results obtained by entomologists in Ohio and Missouri—are not entirely applicable to Georgia conditions, however well they may succeed in the states named. Tobacco dust does not seem to be of much value as a direct remedy, as we have been led to suppose, though, as will be mentioned, it is of value as a fertilizer and probably may be profitable to use as a preventive measure. Our experiments show that kerosene emulsion is the most efficient remedy and that tobacco dust is, at the best, doubtful, hence this bulletin is intended to replace that part of Bulletin No. 13 which deals with the woolly aphis, and to record the actual results of our experiments in 1905 and 1906. The report of the result of experiments with materials that proved to be of little, if any value as a remedy, should be valuable to apple growers, simply to show what experiments have been made, in order that individuals may not waste time and money in making the same experiments. For this reason this bulletin must contain much that is of interest only as a warning to orchardists who are possessed of an experimental turn of mind.

#### **General Plan of Experiments.**

As already mentioned, the first experiments against the woolly aphis were made in 1905. The original plan of the experiment called for the testing of all the remedies that have commonly been recommended, such as, tobacco dust, tobacco stems, whale oil soap, carbon bi-sulphide, etc., and also a test of kerosene emulsion at varying strengths, mixtures of tobacco and kainit, tobacco decoction, etc. In short, the plan was to test all remedies that seemed to possess any possible merit. How thoroughly the experiment was planned the reader may judge for himself.

When the experiment was commenced in 1905 it was expected that the work would be continued in 1906, as we did not wish to base results on one year's work only. Accordingly the work was continued for two years. The result of the first year's work was reported by Harper Dean, Jr., at the meeting of the State Horticultural Society at Macon in 1905,

but in his paper Mr. Dean was careful to state that the report should not be taken as final. Fortunately the general results of the two years' work coincide so closely that it seems just as well to report all the work together. Accordingly in the following pages the result of different treatments tested both in 1905 and 1906, where the results were the same, will be treated as one experiment. The experiments were conducted in both middle and north Georgia, thus providing for the chance of encountering different conditions due to location. Generally speaking, it is believed that the result of the experiments recorded may be depended upon absolutely, making allowance only for varying conditions.

#### **EXPERIMENTS AT MORROW, GEORGIA, IN 1905.**

We are indebted to Mr. J. C. H. Sneed, of Morrow, for allowing us to make experiments in his apple orchard, and in a portion of a block of apple trees in his nursery. The conditions for work at this place were very favorable. The apple orchard contained trees varying in age from six to ten years, showing all degrees of infestation with woolly aphis. A portion of the nursery stock was very badly infested on account of being near the apple orchard, and so located that the aphis had probably spread from the orchard trees to the nursery stock.

Experiments were commenced in this orchard May 11th, 1905, and observations made during that summer and the following spring, 1906. The materials tested were: Tobacco dust alone; tobacco dust and kainit mixed in equal parts; tobacco stems; kerosene emulsion; whale oil soap solution and carbon bi-sulphide. The manner in which these materials were applied will be mentioned farther on.

#### **EXPERIMENTS AT CORNELIA, GEORGIA, IN 1906.**

In order that we might encounter different conditions and also for the purpose of getting grossly infested trees to work on, our experiment in 1906 was established at Cornelia. We are indebted to Col. O. B. Stevens and Mr. S. R. Christie for the use of an orchard at Cornelia in which to carry out our experiments. This orchard consisted of trees averaging about ten years old. In this orchard a test was made of all the materials used at Morrow the previous year and in addition common salt and tobacco decoction were tried. The

tests of tobacco dust, and tobacco dust and kainit mixed, were duplicated in an orchard belonging to Mr. Ethan Philbrick, of Baldwin, to whom we are also greatly indebted. The experiment at Cornelia was commenced March 25th, and finished during April, 1906, except for a second treatment with tobacco dust, and tobacco dust and kainit, made July 12th, 1906. When selecting trees for the experiment it was in all cases necessary to examine the trees and leave out those not actually infested with woolly aphis in order that the final results might be fully depended upon. Infested trees were determined by removing the surface soil and examining the roots.



FIG. 1.—Showing a 3-foot circle of soil removed to prepare apple tree for treatment with some application to destroy the Woolly Aphis.  
(*From Photo*) original.

## REPORT ON RESULTS OF EXPERIMENTS CONDUCTED DURING 1905 AND 1906.

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*(The results of the two years' work are combined as far as possible in order to avoid too much repetition.)*

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It should be understood at the outset that the experiments recorded herewith are intended for finding a means to destroy the root inhabiting form of the woolly aphis, and that they have no direct connection with the aerial form occurring on the twigs and branches. For method of destroying the latter form see page 40. It should also be clearly understood that the experiments were planned with a view of finding a direct remedy for the woolly aphis, with due regard to the effect of the treatment on the trees themselves. Right here it may as well be admitted that some apple growers and others will probably be afraid to follow the recommendations in regard to the use of kerosene emulsion, for fear of its effect on the life of the trees. In anticipation of such complaint we can only say that we have watched closely for damage to the trees and none has been observed, except where so stated. We suggest, however, that the orchardists remember that our experiments were made while the trees were growing or in the spring when they were about to commence growth, and that we would not advise the use of kerosene in any form on the roots of dormant trees. Experience with oils on peach trees for the San Jose scale has shown that dormant trees are sometimes injured when growing trees show no ill effect from the oil treatment.

### **Preparing Trees for Treatment.**

All the materials tested were applied to the trees in practically the same manner. That is, the trees were prepared for the application of either tobacco dust, or any of the dry preparations, or for liquid materials in the following manner:

The soil was removed from about the base of the trees, in

a circle varying according to the size of the trees, to a depth of two or three inches, or enough to partially expose the infested roots. As the trees were prepared the extent of the infestation was noted and recorded and this fact was taken into consideration in determining the result of the various treatments. As already mentioned, only infested trees were used for the experiment. When trees were found on which the aphids were not present, or present in very small numbers, such trees were not included in the test. In that way we eliminated any chance of error because of treating non-infested trees. In the following report it may be understood, unless otherwise stated, that the trees before being treated were prepared as above. In all cases after the trees were treated with a certain material the soil was replaced. That is, when tobacco dust was used it was sprinkled evenly in the opening about the trees and the soil filled in on top to the normal level. The same plan was followed when liquids were used; the aim being to get the material as near as possible to the infested roots.

#### TOBACCO DUST TREATMENT.

The tobacco dust used in the experiment was obtained from a firm in Virginia who sell large quantities of dust to fruit growers to be used as fertilizer, and as an insecticide. The material cost about \$16.00 a ton delivered in Atlanta. Tobacco dust was used at both Morrow and Cornelia. At the latter place a double application was made, first in March 1906, and a second time in July. At Morrow the dust was applied only once, in May, 1905. Both orchard trees and nursery stock were used for the experiment at Morrow, but only orchard trees were treated at Cornelia.

On account of the great variation in the size of the trees it was found to be difficult to use a given quantity of tobacco dust per tree; instead, varying quantities of dust were used on trees of various sizes, and also varying quantities on trees of about the same size. The trees were prepared for treatment in the manner previously mentioned, that is, by removing the surface soil in a circle varying in diameter with the size of the trees, and with the amount of dust used. The soil was removed enough to nearly expose the surface roots. In some cases a circle three feet in diameter was opened, and in others only two feet, while others had the soil removed in

circles of four or five feet in diameter. The variation is shown by the following:

*At Morrow, May, 1905, 10 trees treated as follows:*

Tree 1—	5 pounds tobacco dust,	in 4 foot circle
“ 2—	2 “ “ “ “	2 “ “
“ 3—	3 “ “ “ “	3 “ “
“ 4—	3 “ “ “ “	5 “ “
“ 5—	7 “ “ “ “	4 “ “
“ 6—	10 “ “ “ “	5 “ “

and in other proportions.

The above figures show that tobacco dust was tested in all conceivable proportions. In all instances the dust was evenly distributed in the opening, and the soil replaced on top to the normal level.

Nursery stock was treated at Morrow with tobacco dust in the following manner: Two rows each 50 feet long were selected. A furrow was opened on both sides of one row, the furrow being deep enough to nearly expose the roots. The other row was opened on one side only. Each row fifty feet in length was given an application of ten pounds tobacco dust, this being evenly distributed on each side of one row and on one side only of the other row. Application was made May 13th, 1905.

At Cornelia tobacco dust was applied to 4 plats of three trees each in Mr. Christie's orchard, and two of the plats were duplicated in Mr. Philbrick's orchard. Applied in the same manner as at Morrow, except that the earth around the trees was removed in a circle of four feet in diameter in all cases. Trees varied somewhat in size, but not enough to materially alter the results. All trees were infested when treated.

*Amount of tobacco dust used as follows:*

Plat 1—	6 trees,	7 pounds tobacco dust,	in 4 foot circle
“ 2—	6 “ 4 “ “ “	“ “ 4 “ “	
“ 3—	3 “ 5 “ “ “	“ “ 4 “ “	
“ 4—	3 “ 2 “ “ “	“ “ 4 “ “	

The above treatment was made March 25, 26 and 27, 1906. It will be noted that this was about two months earlier than the treatment at Morrow in 1905. The difference in the result of the treatment may have been due partly to difference in time of application, but the result of the same applications on different dates serves also to strengthen the experiment.

## Effect of Tobacco Dust.

Now, concerning the result of the use of tobacco dust, we find that much variation was apparent. Relative to the treatment of nursery stock, we found that the aphids, two months after treatment were apparently as abundant as on the untreated rows. Where the dust was applied to one side only, of the row, the aphids appeared to be more abundant on the untreated side, showing that they had probably shifted position, but had not been killed. As the aphids were abundant on the row treated with tobacco dust on both sides, it seems certain that they could not have been killed to any extent on the row treated on one side only, but that, as suggested, they had simply shifted position.

On the trees in the orchard at Morrow the result was slightly better than on the nursery stock. But at Cornelia the result was no better. Concerning the result on orchard trees at Morrow we quote from Mr. Dean's report on the first year's work: "The result from this tobacco dust treatment was variable in the extreme. In some instances all the aphids were found to have been killed; again some trees showed only a portion killed, while others showed all the aphids alive." Mr. Dean went on to say that the rainfall after the treatment, and before the final examination, was sufficient to rot the dust and incorporate it thoroughly with the soil, hence giving the tobacco dust a fair chance. The writer was present and assisted in making the examination of the trees, and he feels that the result in general might be said to be of little, if any value. Some untreated trees showed practically no live aphids, indicating the work of some agency which we could not discover.

The result from the use of tobacco at Cornelia was even less satisfactory than at Morrow. At Cornelia the first examination was made two months after treatment, and in no case could it be said that the tobacco dust had killed a perceptible number of aphids. A second examination was made four months after treatment and the same condition prevailed. Treated trees showed as many live aphids as the untreated trees.

## DOUBLE APPLICATION OF TOBACCO DUST.

Plat 1 of the trees treated at Cornelia, which had received 7 pounds of tobacco dust per tree March 26th, was given a second application of dust, of 5½ pounds per tree on July 12th, thus making these trees receive over 12 pounds of tobacco dust in four months. Six weeks after the second treatment examination showed that the aphids were as abundant as on trees that received no tobacco dust whatever.

In view of the above results we feel that apple growers should be warned against attempting to destroy the woolly aphids with tobacco dust on apple trees badly affected by the insect. It is true that tobacco has some insecticidal value, and if used in sufficient quantities it must certainly produce some effect. However, in view of our results we believe that one application of tobacco dust is worth no more than its value as a fertilizer, except when used around young trees, in sufficient quantities to act as a repellent. Undoubtedly the tobacco dust mixed with the soil at the time of planting would be valuable as a repellent, and at the same time act as a fertilizer. Concerning the fertilizer value, in comparison with other fertilizers, it is out of the province of this bulletin to state.

One more word should be said with reference to the use of tobacco dust as an insecticide. Some grades contain a higher per cent. of nicotine than others, and when purchasing this material to use as a fertilizer, it would be well to attempt to get a tobacco dust having the highest possible insecticidal value, especially when the dust is to be used around apple trees. At the same time, if the cost of the grade containing the high per cent. of nicotine is much more than the other grades, the writer would recommend purchasing the tobacco dust for its fertilizer value only.

## TOBACCO STEMS TREATMENT.

Tobacco stems were applied to orchard trees at Morrow in 1905 and at Cornelia in 1906. Application was the same as with tobacco dust. At Morrow the stems were used in varying amounts of from 3 to 12 pounds per tree in circles around the trees varying from 3 to 6 feet in diameter. At Cornelia the stems were applied in two strengths of 4 and 6 pounds to a tree in a circle of 4 feet in diameter. About 25 trees were

included in this test. As the stems are usually secured they are dry and hard to handle, especially to pack about the trees. To overcome this difficulty the stems were moistened before using. It was found that 4 to 6 pounds of stems were so bulky that when the earth was replaced on top the trees were surrounded by a mound three to four inches high. As the stems rotted the soil packed down again to its normal level. In practice it was found that the stems were more trouble to handle than the tobacco dust, and this fact alone will no doubt deter people from making use of this remedy.

Concerning the result of the use of tobacco stems, at Morrow in 1905 it was found that they were a little more effective than the tobacco dust, but at Cornelia in 1906 the stems did not appear to kill a perceptible number of aphids. Why such a difference should appear we are unable to state, but in general it should be understood that either tobacco dust or stems are far from being a fairly good remedy. Unless tobacco stems are easy to obtain, and at a cost of not more than \$12.00 a ton, it would not seem advisable to use them except for their fertilizer value.

#### **KAINIT TREATMENT.**

As kainit has so often been recommended for destruction of insects in the soil, it was decided to test its value against the woolly aphid. Accordingly the following experiment was made:

Three plats of three 10-year old trees each were treated at Cornelia with 4, 6 and 8 pounds respectively on March 27th, 1906. These trees were examined on May 12th and July 12th, and at both examinations the aphid did not appear to be reduced in numbers to a perceptible extent. The kainit of course acted beneficially as a fertilizer, but against the woolly aphid it had no effect that could be determined.

#### **TOBACCO DUST AND KAINIT TREATMENT.**

Tobacco dust and kainit, mixed in equal parts, was used in exactly the same manner as tobacco dust alone. The mixture was applied at strengths varying from 3 to 12 pounds per tree distributed in circles of 3 to 6 feet in diameter about the trees. By referring to the use of tobacco dust at Morrow the reader will understand just how this mixture was tested. The experiment was conducted at Morrow, 1905, and at Cor-

nelia in 1906. Treatment at Morrow was made May 12th and at Cornelia March 26th, both applications being followed by sufficient rain to thoroughly incorporate the mixture with the soil. In fact, at the time the trees were examined it was almost impossible to distinguish the tobacco dust and kainit in the soil.

Here again we obtained varying and conflicting results. At Morrow, 1905, the tobacco dust and kainit mixture appeared to kill about one-half the insects, or in other words, the treatment was about as effective as the tobacco stems. Compared to the tobacco dust alone this treatment was somewhat better, but not sufficiently so to be called effective. It was noted particularly that the aphids were abundant just beyond the circle of tobacco dust and kainit, and after the strength of the mixture was somewhat exhausted, it appeared that the young aphids immediately worked their way in toward the body of the trees. Unless the mixture could be applied frequently, at least three times during the summer, the ultimate effect would be of little value.

At Cornelia, 1906, the tobacco and kainit did not appear to kill a perceptible number of aphids. This was not due to dry weather, preventing the mixture from rotting, for when examined the mixture appeared to be well rotted and mixed with the soil. On the whole we are forced to conclude that tobacco dust and kainit mixture is of some value if used two or three times during the summer, applying not less than five pounds each time to 8 or 10 year old trees. Less than that amount would not kill enough aphids to pay for the application. Its fertilizer effect should of course be taken into consideration.

#### COMMON SALT TREATMENT,

Only two experiments were made with common salt. The first was an application of 4 pounds per tree and the second 6 pounds per tree. This experiment was made at Cornelia, 1906. The result was rather surprising. 4 pounds per tree did not kill a perceptible number of insects, while 6 pounds per tree killed nearly all the aphids. This result does not seem right, and we are inclined to think that the aphids were not as abundant on the trees receiving 6 pounds of salt as on the ones receiving the other application, and that we should not put too much dependence on this experiment. The salt

was applied over the roots in an opening around the trees the same as the tobacco dust treatment previously mentioned. We suggest that this remedy be given a test, but caution the orchardists against expecting to obtain the result apparently shown by our experiment.

### **TOBACCO DECOCTION TREATMENT.**

Knowing that tobacco in dry form was not an effective remedy for the woolly aphis it was decided to try using the tobacco in the form of a decoction made by boiling tobacco stems in water, and applying the solution to the roots of infested trees. This experiment was made at Cornelia, 1906. Tobacco decoction was made in the following manner: 3 pounds tobacco stems were boiled in 5 gallons of water for at least two hours, and the solution applied full strength. This was tested also at one-half strength, each test including three trees. Trees were prepared for receiving the tobacco decoction by removing the surface soil, the same as for tobacco dust, and the decoction was applied in the opening in sufficient quantity to saturate the soil to a depth of  $2\frac{1}{2}$  to 3 inches. Of course it eventually penetrated to a much greater depth. In this experiment 4 gallons of decoction was used in a circle  $3\frac{1}{2}$  feet in diameter, and 7 gallons in a circle 5 feet in diameter.

### **Effect of Tobacco Decoction.**

The result from the use of tobacco decoction was disappointing. The treatment was made on march 28th, and the trees examined May 12th, July 25th, August 28th, and October 19th. At no time could we see that the treatment had killed a perceptible number of the aphis. Were it not for the expense of the treatment and the fact that kerosene emulsion has proven so effective, we would recommend using tobacco decoction at double or treble the strength tested above. The reader should understand that tobacco decoction should not be condemned absolutely until greater strengths have been tried. This report is offered as a matter of interest, rather than as conclusive evidence that tobacco decoction is of no value against the woolly aphis.

## WHALE OIL SOAP TREATMENT.

Knowing that whale oil soap solution at the proper strength is a good remedy for nearly all plant lice, it was decided to try using the soap solution as an application in liquid form against the woolly aphid. The whale oil soap selected for the experiment was Good's Caustic Potash Whale Oil Soap, No. 3. This soap costs in one hundred pound lots about four cents a pound.

The plan selected for applying the soap solution to infested trees was to remove the surface soil enough to nearly expose the infested roots, just as was done for the tobacco and other treatments. The soap solution at varying strengths was then to be applied to the soil in sufficient quantities to saturate the earth to a depth of  $2\frac{1}{2}$  to 3 inches, after which the earth was to be replaced to the normal level. This plan was followed throughout the experiment. The plan of the experiment called for testing the soap solution at the following strengths:

Whale Oil Soap-----	2	pounds	per	gallon	water				
" " " -----	$1\frac{1}{2}$	"	"	"	"	"	"	"	"
" " " -----	1	"	"	"	"	"	"	"	"
" " " -----	$\frac{1}{2}$	"	"	"	"	"	"	"	"

At Morrow, 1905, nursery stock was treated with all the above strengths except 2 pounds to a gallon of water. The nursery stock was prepared for treatment by opening a small furrow on each side of the row. This furrow was made about two inches deep, enough to hold the solution until it could soak into the earth. (See Fig. 2.) Three rows of 25 feet each were selected, care being taken to see that some of the trees were infested with woolly aphid. Three gallons of soap solution were used to each 25 feet of nursery stock. The application was given June 3rd. After the trees were treated the soil was replaced to the normal level. On July 28th the stock was examined with the following result:

All the stock was found slightly infested with the aphid, though less than at the time the soap solution was applied. At first it was supposed that the treatment had been quite effective. However, upon examining the untreated stock it was found that the aphid had also decreased in numbers, and the treated trees were really as badly infested as the untreated trees. The hot, dry weather was probably responsible for

this decrease in numbers of the aphids. On the whole we were forced to conclude that the whale oil soap solution was not effective.

At Cornelia, 1906, orchard trees, about ten years old, were treated with all four strengths of soap as mentioned above. The trees were prepared for treatment by removing the surface soil in circles of  $3\frac{1}{2}$  to 4 feet in diameter. It was found that this area required about 3 gallons of solution to saturate the soil to a depth of  $2\frac{1}{2}$  to 3 inches. Only infested trees were used and the trees were treated on March 30th. Examination of the trees for the effect of the treatment was made on May 12th and July 12th. The result corresponded with that observed at Morrow the previous year. At no time could it be said that the whale oil soap had killed any of the aphids.

We must confess that the result from the use of whale oil soap was a disappointment, for it was expected that at least a large percent. of the aphids would be killed. However, the results obtained compel us to state that this treatment has no value against the woolly aphids.

#### **TOBACCO POTASH WHALE OIL SOAP TREATMENT.**

A tobacco potash whale oil soap manufactured by James Good, Phila., was tested at Cornelia in 1906 at the same strength as the regular whale oil soap mentioned above. This treatment was made with the hope that the presence of tobacco in the soap would make it more effective than the ordinary whale oil soap.

It is needless to go into the details of this experiment. Suffice to say that the result with all strengths, varying from  $\frac{1}{2}$  pound soap per gallon of water to 2 pounds soap per gallon of water, was no more effective than the ordinary whale oil soap solution.

#### **CARBON BI-SULPHIDE TREATMENT.**

This is a clear, colorless liquid, which vaporizes rapidly when exposed to the air, and the fumes of which are deadly poison to nearly all insects. Carbon bi-sulphide is used for destroying grain insects, by placing the liquid on top of a bin of grain and allowing the fumes, which are heavier than air, to sink down into the grain. In tight bins this treatment is perfectly successful. For this and other reasons it was

thought that the liquid might be injected into the soil around trees infected with the woolly aphis, and thus prove to be a valuable remedy.

Carbon bi-sulphide has been recommended by Prof. J. M. Stedman of Missouri as an effective remedy for the woolly aphis, hence in planning our experiments we hoped to secure satisfactory results. The following report, however, will show how badly we were mistaken.

As carbon bi-sulphide is a liquid that evaporates rapidly in the air, it was necessary to arrange to place the liquid in the soil, about the trees, in small holes that could be completely and quickly closed. For want of a regular injector, such as was used by Prof. Stedman in Missouri, we adopted a plan which was cheap and simple, and answered the purpose in every way.

An iron rod three feet long and one-half inch thick was sharpened at one end and used to make holes 4 to 5 inches deep. A six inch piece of one-fourth inch gas piping was placed in the hole and the liquid poured through the pipe by the aid of a small funnel. After removing the pipe the hole was closed by pressing the earth down firmly with the heel. The required amount of carbon bi-sulphide was measured out in a graduated glass tube, 30 cc. representing one fluid ounce. Trees were treated in various ways, using different amounts per tree and placing the liquid at various distances from the trees. The following is a synopsis of the strengths tested, amount used per tree, and the manner of applying:

1	oz.	Carbon bi-sulphide	on 3 sides	15 ins.	from trunk				
1	"	"	"	"	3	"	24	"	"
1	"	"	"	"	2	"	15	"	"
1	"	"	"	"	2	"	24	"	"
1	"	"	"	"	4	"	18	"	"
1/4	"	"	"	"	5	"	15	"	"
1 1/2	"	"	"	"	4	"	12	"	"
2	"	"	"	"	3	"	12	"	"

and a few other strengths.

The above figures will show that the carbon bi-sulphide was given a thorough test. Now concerning the results:

### Effect of Carbon Bi-Sulphide.

The above tests were made in 1905 at Morrow and in 1906 at Cornelia. As the result at both places was about the same they may as well be stated together. It was found that the woolly aphids were killed over an area of a few inches around where the application was made, but in all instances where the trees were uninjured the aphids were alive in spots between the holes in which the liquid was applied. All the trees receiving as much as 2 ounces on three sides, at a distance of twelve inches, were killed or badly injured. This was the result of treatment at Morrow. At Cornelia the strongest application given was 1 ounce on four sides of each tree at a distance of 18 inches from the trunk. This treatment did not injure the trees nor did it kill all the aphids. Evidently the carbon bi-sulphide cannot be used in Georgia soils, in sufficient quantities to kill the aphids without at the same time injuring the trees. We wish it clearly understood that this substance will kill woolly aphids whenever the fumes of the liquid come in contact with the insects, but in view of our results we do not think it safe to recommend its use. There is too much danger of injury to the trees and too little chance of the treatment killing a reasonable number of the aphids.

Too much space has been taken in reporting these experiments, but we feel that the apple growers should know what work has been done. We now come to the only experiment that has proved to be a direct and effective remedy for the woolly aphids as far as our experience teaches us.

### KEROSENE EMULSION TREATMENT.

The writer has always thought that kerosene emulsion might be used successfully against the woolly aphids. In planning our experiment this material was therefore given a prominent place, and the result proves the value of the experiment.

Kerosene emulsion used in all our experiments against the woolly aphids was made by the following formula:

{	Kerosene -----	2 gallons
{	Whale Oil Soap (any strong potash soap may be used) -----	1½ pound
{	Water -----	1 gallon

### *Direction for preparing.*

Place a kettle containing one gallon of water over a fire and in it dissolve the soap. The water should be boiling hot. Remove this solution from the fire and add two gallons of kerosene and agitate the mixture violently for about ten minutes. As the kerosene and soap solution combine a smooth, creamy emulsion will result, the bulk will increase somewhat, and when properly emulsified it will remain without separating for several weeks. The proper emulsion is most easily prepared by the use of a small force pump, equipped with a nozzle having a direct discharge, throwing a one-eighth inch stream, and pumping the solution back into itself with considerable force. After ten minutes pumping the emulsion should be perfect. The emulsion should always be agitated for ten minutes, otherwise the kerosene may separate and rise after standing a short time. Soft water should be used for making emulsions, but if such water is not readily obtainable, hard water may be used by the addition of a little lye.

The stock solution of emulsion may be diluted to the required strength by adding the following amounts of water:

For 10 per cent. emulsion dilute with 17 gallons of water

For 15 per cent. emulsion dilute with  $10\frac{1}{3}$  gallons of water

For 20 per cent. emulsion dilute with 7 gallons of water

Emulsion prepared in the above manner was tested at strengths as follows: 10, 15, 20, 30 and 40 per cent. Badly infested trees were selected for the experiment both at Morrow in 1905 and at Cornelia in 1906. 32 apple trees varying in age from 6 to 12 years, and a row of two-year-old nursery stock were included in this experiment. The trees were prepared for treatment in the usual manner. The diameter of the circle of earth removed from about the trees, varied with the size of the trees and the spread of the infested roots.

*Without going into details concerning the different tests of kerosene emulsion it may be stated that all the aphids were killed by every application, from the weakest to the strongest, wherever the emulsion came in contact with the infested roots.* In all cases the emulsion was applied in quantity sufficient to saturate the soil to a depth of  $2\frac{1}{2}$  to 3 inches in the opening, after the surface soil was removed, and immediately after treatment the earth was replaced to the normal level. Later examination showed that the emulsion soaked down to a depth

of 10 or 12 inches in many cases. Hence in practice we do not believe it necessary to use quite as large quantities as was used in our experiments.

At Morrow in 1905 the treatment with kerosene emulsion was made on June 2nd and 3rd. The examination of the treated trees was made July 28th and September 12th, 1905, and again in the spring of 1906. None of the trees showed any sign of being injured by the kerosene. This is remarkable considering the fact that 40 per cent. emulsion was used on 7 trees in the orchard and on a row 75 feet in length of two-year-old nursery stock. The treatment of nursery trees may be considered as a particularly severe test, but no injury resulted.

At Cornelia in 1906 the treatment with kerosene emulsion was made March 29th and 30th, and the trees were examined May 12th, July 11th, and October 19th. Only two trees were treated with 40 per cent emulsion and one of them died completely, while the other showed some sign of injury. The trees treated with 10, 15, 20, and 30 per cent. emulsion did not at any time show signs of injury. All the aphids were killed by the emulsion in the circle where the application was made. Trees from which the soil was removed to a distance of two feet on all sides, or in other words, in a circle of over four feet in diameter, were in some instances entirely freed from the aphids. On trees where the earth was not removed over 15 inches on all sides, live aphids was sometimes found outside the circle receiving the application. These conditions prevailed on all the trees treated with kerosene emulsion. There were no exceptions. Wherever the kerosene emulsion was applied the aphids were killed.

#### **Lasting Effect of Kerosene Emulsion.**

It is not enough to state that the emulsion killed all the aphids. It did more. The odor of kerosene remained in the soil for several months and acted as a repellent. Mr. Reed examined trees July 11th which had been treated with 20 per cent. emulsion on March 30th, or in other words, 3½ months after the application, and found that the kerosene odor was quite perceptible in the soil to a depth of twelve inches. Even the 10 per cent. emulsion was sufficient to cause the

earth to smell of kerosene three months after treatment, though the odor was not as strong as where the stronger emulsion was applied. The same condition was observed at Morrow in 1905. Trees treated with 20 per cent. emulsion on June 3rd were examined on September 12th, and at that time, over three months after treatment, the odor of kerosene was detected in the soil.

*As a repellent the kerosene emulsion acts perfectly. It is true that aphids may live outside the circle treated with the emulsion, but as long as the odor of the kerosene remains in the soil the young aphids will not work back to the main roots of the trees.* Those who are most familiar with the work of the woolly aphid will understand that it is not possible, by any ordinary treatment, to kill the aphid on roots several feet from the trunk of the trees, nor is that necessary. If kept off the main roots for a distance of three feet on all sides, the aphid will not be able to seriously injure such trees. Where the old roots of badly infested trees have been seriously damaged by woolly aphid, if the aphid are killed, and the trees given good attention otherwise, new roots will form to give the trees new life.

#### **Caution Against Using Kerosene Emulsion on Dormant Trees.**

Our work with kerosene emulsion does not prove conclusively that it should not be used while trees are dormant, but the result of using 40 per cent. emulsion at Cornelia, March 29th, before the trees had commenced to grow, would indicate that the emulsion should not be used on orchard trees while they are in a dormant condition. This opinion is strengthened by the results obtained in Georgia and other states from the use of kerosene emulsion on dormant peach trees. We have frequently used the emulsion at 20 and 25 per cent. strengths, in summer on peach trees without injury, but the same strength used in winter has often proved disastrous. The reason for this is evidently owing to the fact that when the trees are full of sap the kerosene does not penetrate enough to cause injury. This statement is made to help explain why we warn apple growers against using kerosene emulsion on dormant trees. When kerosene emulsion is used at the strength recommended below we do not believe the trees would be injured at any time of year, but in the absence of definite information concerning

this point it seems best to recommend kerosene emulsion treatment for spring after the trees commence to grow, or during summer, before the last of July. In apple orchards where cultivation is not kept up during summer the trees are liable to stop growing after July. Furthermore, when recommending kerosene emulsion for spring or early summer treatment, we consider the fact that much damage from woolly aphis may be prevented if the insects are killed early in the season.

#### **What Strength to Use and How Much.**

Kerosene emulsion at 10 and 15 per cent. strength has proved, in our experiments, to kill all the aphis reached by the emulsion. 20 and 30 per cent. have not injured a single tree. After careful consideration of the subject we believe it best to recommend the use of 15 per cent. emulsion for treating badly infested trees. *The odor of the kerosene at 15 per cent. strength will extend farther away from the circle of application than the 10 per cent. strength, and for that reason it will in general be found most thoroughly effective.*

Concerning the amount of emulsion to use the grower must depend largely on his own judgment. The amount should vary with the size of the trees, the degree of infestation, and the spread of the infested roots. In all cases it would be best to remove the soil about 15 to 18 inches on all sides of the trees to a depth of  $2\frac{1}{2}$  to 3 inches, or enough to partially expose the infested roots. In a circle of this size the amount of emulsion necessary to saturate the soil 3 to 4 inches deep, will usually be from  $2\frac{1}{2}$  to 3 gallons. The soil should be fairly dry when the emulsion is applied, if the best results are to be obtained. Large trees having infested roots spreading out 3 to 4 feet on all sides should be prepared for treatment by removing the soil in a circle of not less than 5 feet in diameter. For this area it will generally take about 5 to 6 gallons of emulsion. In all cases replace the removed soil after the emulsion has been applied.

#### **Cost of Treatment With Kerosene Emulsion.**

The cost of applying kerosene emulsion will vary greatly with the size of the trees and the amount necessary to use. The individual may easily figure out the cost for himself. Apple trees from 4 to 10 years of age, if of ordinary size, should be treated at a cost of from 4 to 8 cents per tree. This

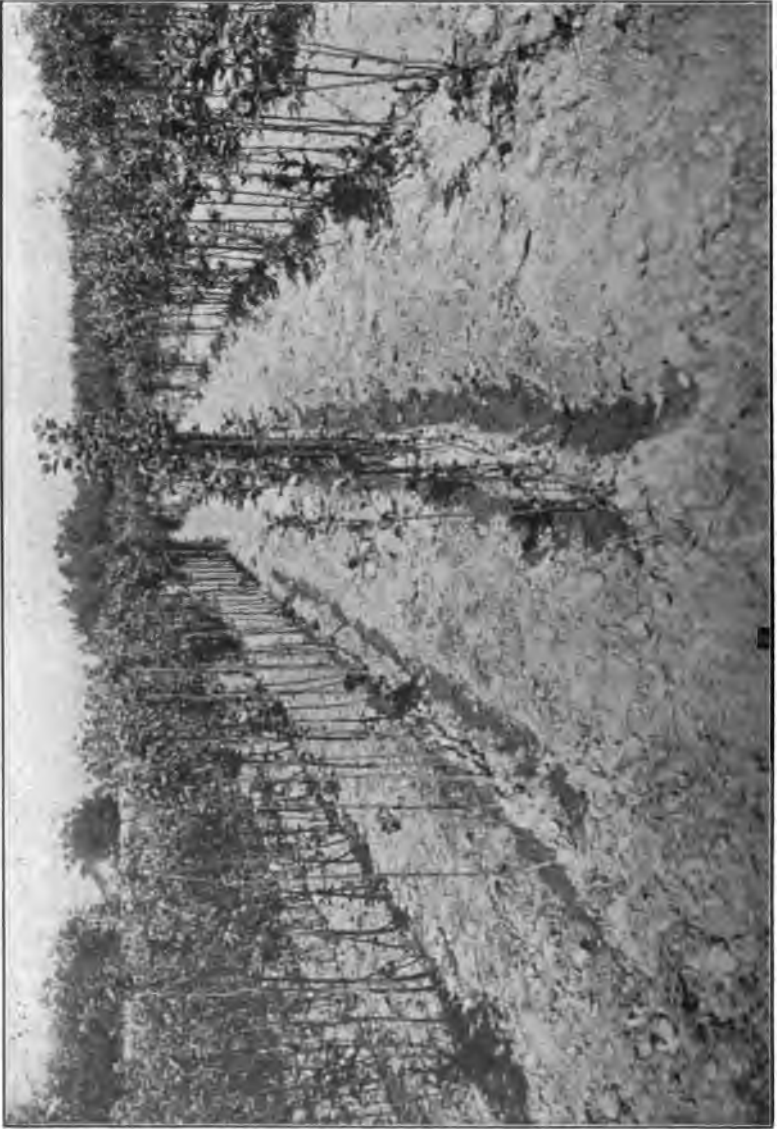


FIG. 2.—Showing how nursery stock was treated with kerosene emulsion. This photograph shows the open furrows after emulsion has been applied. (*from Photo-original.*)

figure is based on using emulsion at 15 per cent. strength. At 10 per cent. the cost would be reduced somewhat. Compared with tobacco dust treatment the kerosene emulsion is fully as cheap, and considering that the latter treatment may be thoroughly depended upon to kill the aphid, the emulsion might well be considered by far the cheapest. One application of either 10 or 15 per cent. emulsion will be found sufficient for one year. We believe that treatment for two years in succession will practically destroy all the aphid on ordinary sized trees. Large trees are naturally more difficult to treat thoroughly, because the aphid may be on roots five or six feet distant from the base of the trees. Of course it is impracticable to attempt to kill the aphid by direct treatment except over a limited area.

#### **TREATMENT OF NURSERY STOCK WITH KEROSENE EMULSION.**

Nurserymen should make use of this treatment. Infested stock may be treated in the field where it is growing, or the trees may be taken up and dipped. Orchardists who purchase stock will find it worth their trouble to dip all stock before planting. For treating nursery stock in the rows (see Fig. 2) we recommend using 10 per cent. emulsion. This is strong enough, as the roots of the stock do not extend far and the emulsion will reach practically all the aphid. This treatment is easier than treatment of infested orchard trees.

For dipping nursery stock we recommend the use of 15 per cent. kerosene emulsion. The stock should be freed from all lumps of dirt, and the roots dipped in the emulsion for a minute or two and then spread out to dry for a few minutes. After trees are dipped they should not be piled in heaps, on account of the danger of the drip from the upper trees running down and accumulating on the ones below. If this occurred the lower trees would in reality receive a double, or even greater treatment, which might result in severe injury to the stock.

Mr. J. C. H. Sneed, of Morrow, Ga., has practiced dipping nursery stock in 20 per cent. kerosene emulsion without injury to the trees. However, we believe that 15 per cent. strength is equally effective, and of course somewhat cheaper.

### CAUTION.

Nurserymen and orchardists should be cautioned especially against using improperly prepared kerosene emulsion for dipping trees. If the kerosene appears to rise to the top of the bucket, barrel, or whatever is used for dipping the stock, the emulsion should be at once discarded and a fresh supply prepared. Pure kerosene will injure almost any kind of tree, and if one attempts to dip nursery stock in emulsion that shows some free kerosene on top, it is almost like dipping the roots in pure kerosene.

## THE APPLE WOOLLY APHIS.

*Schizoneura lanigera.* Hauss.

### General Description and Injury.

This portion of the bulletin is intended to give as accurate an account as possible, of the injury, habits and life history of the woolly aphis. It does not contain an account of original research work, nor any particularly new facts concerning the insect, but simply general information which the apple grower should know. Without this general knowledge of the insect and its work the reader might not be able to thoroughly appreciate the value of the experimental work to which the first part of this bulletin is devoted.

The woolly aphis belongs to the same family of insects as the plant lice which infest the buds and leaves of the apple during spring and early summer (for description of leaf aphis see page 41), and differs greatly from the latter in appearance by secreting a white cottony substance from its abdomen, and infests principally the roots of the apple trees. There is an aerial form of woolly aphis which appears in summer on the trunk, limbs, or branches, occurring usually in wounds made by pruning, or in bruised places on the bark. Every apple grower has probably seen small cottony masses, sometimes only the size of a dime, but often extending for several inches along a crack in the bark, or in the wound made by cutting off a limb. If he had examined these masses he would in all probability, have found underneath numbers of brownish colored insects of various sizes, but none larger than a pin-head. If the fruit-grower has seen these things he has seen the aerial form of the woolly aphis. (See Fig. 3.) The damage caused by this form is little more than a killing of the bark at the point of attack.

In addition to the aerial form, there is a root infesting form of woolly aphis, which occurs on the roots, and by feeding thereon cause abnormal swellings or galls that may get

to be the size of the galls shown in Figs. 5 and 8. If the grower has examined the roots of trees infested by the woolly aphid he has seen the galls and also the insects causing them. The whitish cottony secretions of the insects are not as pronounced on the roots as on the branches, but this covering is always present to a greater or less extent. On young trees, and consequently young roots, the galls are often small, and may appear very much like Fig. 4. If the reader will glance again at Fig. 8 he will notice a mass of young fibrous roots growing out from near the crown of the tree. This is the characteristic appearance of the roots of a badly infested apple tree. The presence of young fibrous roots indicates that the tree is attempting to establish a new root system to replace the ones injured by the woolly aphid. When trees are infested these new roots may be attacked almost as soon as they appear, making it necessary for the tree to throw out more roots. Hence it is not uncommon to find a mass of small, mostly dead roots, at the base of main roots which have been badly damaged by the attack of the woolly aphid.

From this general description, the reader should be able to examine apple trees and judge whether or not they are infested with woolly aphid.

#### Origin and Distribution.

Concerning the original home of the woolly aphid scientists hold different opinions. The insect is widely distributed throughout the world. In Europe this species causes galls on limbs and branches, sometimes so serious as to kill trees, but in this country the greatest injury occurs on the roots. The woolly aphid occurs in Europe where it is called "American blight" on account of its being supposed that the insect was introduced there on nursery stock from America. Some writers claim that the insect is a native of Europe. It matters not, however, for the purpose of this bulletin, where the insect originated. All we need to know is its life history and habits and how to destroy it.

In Northern United States the woolly aphid is quite serious in its aerial form, while the root form does not cause such great injury. In the Southern States, however, the conditions are reversed. The root inhabiting form is the one we have to fear. In Georgia the woolly aphid may be found in



FIG. 3.—Woolly Aphis.  
Aerial form, natural size.

FIGS. 3 and 4.—(*From  
Bul. 45, Vir. Crop Pest  
Comm.*)



FIG. 4.—Woolly Aphis. Root infesting form

nearly every apple orchard, and in most of the nurseries where apple trees are grown.

#### **Description of the Various Forms.**

The woolly aphid occurring on the roots, frequently called "the apple root louse" and the ones known as the "aerial" form do not differ greatly in appearance. In reality they are of the same species. The individual insects are reddish brown in color, and vary in size according to their age. Full grown individuals are about the size of a large pin-head. The young, which may always be found in colonies during summer, are very small. Any one wishing to get a good idea of the true appearance of the insects should take a magnifying glass and break into one of the cottony masses, either on the branches or on the roots. Most of the insects will then appear like Fig. 7c, or like the winged individual in Fig. 6. It will be observed that the cottony substance is secreted from the abdomen of the insects, and serves only as a protection. Its white appearance is a good guide to the location of the insects, particularly of the aerial form. In fact, the writer believes that the aerial form in Georgia is a benefit, rather than otherwise, on account of serving to show that the roots of the tree are probably also infested. Colonies of woolly aphid may occur on trees, of which the roots are not affected, but this is seldom true.

We should now understand the relation of the two main forms of woolly aphid, namely, "root form" and "aerial form," and in the next paragraph the migratory and non-sexual forms will be mentioned.

#### **Life History.**

To give a fair idea of the history of the life of a colony of aphid for one year let us begin with the form occurring on the roots in mid-summer. At this season most of the individuals are wingless, agamic females, capable of giving birth to living young at the rate of 2 to 20 per day, according to Alwood.\* These females are non-sexual, and their offspring develop into wingless, non-sexual (agamic) females. This form is most abundant during the summer. Late in the season—we do not know the exact date—a few winged agamic females are produced, and are known as the migratory form.

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\*Vir. Crop Pest Com. Bul. No. 45



**FIG. 5.—Woolly Aphis Galls on Roots taken from badly infested tree.**  
(*From Photo.*)

Some of them migrate to the limbs of the tree on whose roots they were born, or to other trees in the neighborhood, and there start new colonies. These winged forms also give birth to living young, but unlike the young from the wingless form, these are true males and females. Each true female insect develops one solitary egg, which is nearly the size of the insect itself. According to Prof. Stedman\* of Missouri, these eggs may be found in crevices of the bark during winter. Prof. Alwood, of Virginia, has succeeded in securing the eggs in the laboratory in breeding jars, but he states that careful search has not revealed them among the old colonies. We do not know from observation that the eggs are developed in Georgia, but it is highly probable that they do occur.

The wingless agamic females persist throughout the year in this climate. By digging down to the infested roots live aphids may be found any month of the year. It is probable that the insects hibernate, that is, they are not active during a part of the winter, but they commence to work early in spring, and continue active well into the fall months.

The reader will now understand the way new colonies are started. Early in spring the eggs develop into wingless agamic females similar to the ones found in the colony with which we supposedly started the year previous. Young are brought forth alive, as before, the colonies increase during the summer, and later more winged females are developed for the perpetuation of the species.

A single agamic female may give birth to over 100 young in a period of two weeks or more before death. As the colonies continue to produce young all during the summer months it is not surprising to find how rapidly the numbers of aphids may increase. In experimenting with remedies we found that it was necessary to kill practically all the insects in spring, or else the few remaining would increase to injurious numbers before the end of the season. By using a preparation like kerosene emulsion which not only kills the insects present at the time but acts as a repellent for several months, we have a remedy that is very nearly perfect.

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\*Mo. Exp. Sta. Bul. No. 35.

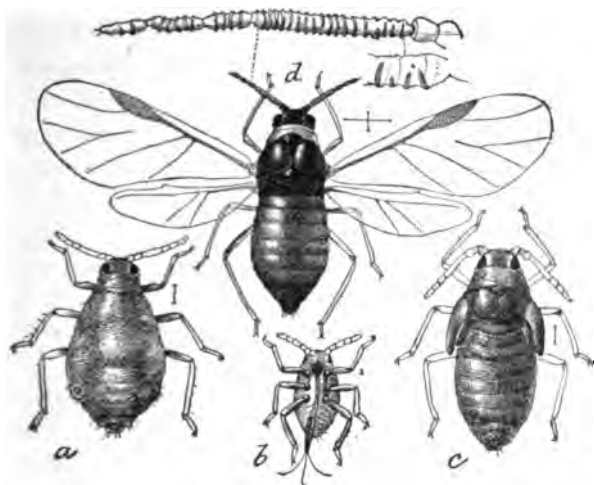


FIG. 6.—Woolly aphid (*Schizoneura lanigera*). *a*, Agamic female; *b*, larval louse; *c*, pupa; *d*, winged female with antenna enlarged above; all greatly enlarged and with waxy excretion removed. (Marlatt, Circ. No. 20, sec. s., Div. of Ent., U. S. Dept. of Agr.)

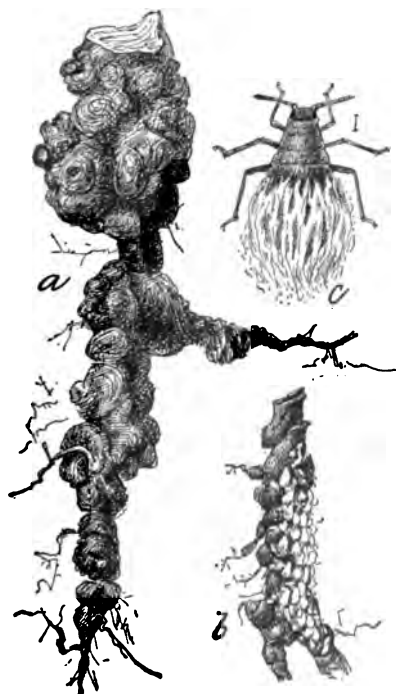


FIG. 7.—Woolly aphid (*Schizoneura lanigera*). *a*, Root of young tree illustrating deformation; *b* section of root with aphids clustered over it; root louse, female—*a* and *b*, natural size; *c*, much enlarged. (Marlatt Circ. No. 20, sec. s., Div. of Ent., U. S. Dept. of Agr.)

### **How Galls are Produced.**

Like all plant lice the woolly aphid feed by means of piercing and sucking beaks. Their food therefore consists entirely of the juices of the plant. The presence of woolly aphid on the roots or wherever they may happen to feed always has the effect of producing galls as shown in Figs. 4, 5 and 8. The galls produced by the aerial form are not often, in this State, serious enough to injure the trees. Wherever the insects feed galls of greater or less size are produced, but it is the galls formed on the roots with which Georgia apple growers are mainly concerned.

The presence of great numbers of woolly aphid on the roots will always result in galls of considerable size. These galls are really an abnormal growth of the tissue of the roots, caused probably by some poison injected into the tissue by the insects. As the galls increase in size and numbers the injured roots soon commence to decay, and their destruction is no doubt hastened by the entrance of fungi and bacteria. As the roots die the aphid die or move to other roots so that when looking for the first time, for signs of woolly aphid, one might find trees that have been injured, but the aphid all gone from the affected roots. This fact, however, should not lead one to arrive at an erroneous conclusion regarding the cause of the injury. If further search were made live aphid would probably be found on the live roots, if there were any such on the trees. It is the rotting and destruction of the affected roots that make the damage from woolly aphid attack so disastrous, for as fast as roots are killed by the insects new roots will be formed, as long as the tree retains sufficient life. This continual drain on the vitality of the tree soon results in a sickly, dwarfed growth as mentioned in the next paragraph.

### **Appearance of Infested Trees.**

Apple trees having the roots infested with woolly aphid may often be detected by the outward appearance of the trees without ever examining the roots. Badly infested trees usually have a sickly appearance, indicated by a yellowish foliage, a scarcity of leaves, and often by a dwarfed growth. When trees have been infested for two or three years, or longer, the roots are often so badly damaged by the attacks of the aphid that the trees may be easily pushed over. In fact, infested



**FIG. 8.**—Woolly Aphis Galls on ten-year-old apple tree. Notice mass of  
 Fibrous Roots. *(From Photo).*  
 denoting Crown Gall.

trees are sometimes blown over by high winds, on account of having the main roots weakened, or entirely destroyed. It is not uncommon to find apple trees dying and when pulled out the roots found to be completely decayed. Frequently such trees have been injured by the woolly aphid without the owner suspecting the cause of the injury.

As mentioned above, the aerial form of woolly aphid occurring on the branches is easily detected and may generally be taken as an indication that the roots are infested. Such trees should be carefully examined at the roots and if aphid are discovered apply the remedy as mentioned in another portion of this bulletin.

#### **DESTRUCTION OF AERIAL FORM OF WOOLLY APHIS.**

The small masses of woolly aphid occurring on the trunk and limbs may be killed by kerosene emulsion (see directions for making on page 23) or by the use of tobacco decoction (see page 19). Where only a few aphid are present we advise using the tobacco decoction. It may be applied by using a cloth or brush, or with a spray pump. The masses of aphid must be thoroughly saturated in order to penetrate the woolly covering, otherwise the insects beneath will not be killed.

## THE GREEN APPLE LEAF APHIS IN GEORGIA.

*Aphis pomi*—DeGeer.

### INTRODUCTION.

Every apple grower should become acquainted with this insect which feeds on the leaves during spring and early summer, causing them to curl, blacken and die. It is true that the aphid first appear as the buds are opening, but unless the grower is thoroughly familiar with the insect he will overlook their presence until the leaves commence to curl from their attack. The first prominent indication of the presence of leaf aphid is the curled leaves, which soon blacken, wither and die. Young apple orchards and apple nursery stock are yearly damaged by this insect, resulting in a dwarfed, stunted, deformed growth, and occasionally in the death of the infested trees. Young orchard trees and nursery stock suffer most severely, but old apple trees are also attacked.

Green apple aphid when present usually occur in great numbers on the terminal twigs. Fig. 10 does not give an illustration of an extreme case. The aphid are often found in even greater abundance on a single twig. Aphid attack as stated, results in curled and blackened leaves, the curling being due mainly to the fact that the insects suck the sap from the under surface only, and the blackened appearance due to the development of a sooty fungus, which thrives on the honey dew secreted by the aphid. The leaves curl for the same reason that paper wet on one side only will curl. The curling is due to the expansion of the surface containing the most moisture, for example, wet paper curls toward the dry surface, and in like manner the leaves curl toward the side from which the sap is extracted by the aphid. This characteristic effect of aphid attack, causing the leaves to curl downward or toward the under side, has an important bearing on the matter of remedies. It is evident that any remedy in the form of spray, would be most efficient when applied before the leaves curl badly, otherwise it would be almost impossible to make the spray reach all the insects.

It seems almost unnecessary to state that remedies must be applied in the form of contact poisons, for the insects do not devour any portion of the tissue of the leaves; hence they cannot be fought with a poison like Paris green that must be taken in with the food.

In the following paragraphs will be given a brief description and life history of the apple leaf aphid. Following that the matter of remedies is discussed.

#### Concerning Different Species.

As this bulletin is prepared mainly for the practical apple grower, the matter of related species, that may occur at times in Georgia, will not be discussed at length. Also owing to the fact that the writer has not been able to make a study of the life history of the apple leaf aphid in Georgia, the reader is asked to remember that the description and remarks on life history, may not be in all respects, absolutely correct. They will serve, however, to give the reader a fairly complete idea of the habits and appearance of the common apple aphid.

Probably two or three, or more, species of plant lice occur on apple trees in this State. As it is impossible in a brief space to mention all of them, a description will be given of the species now known as *Aphis pomi*, which has often been confused with other species. The following description and life history notes are based on the work of Dr. John B. Smith,\* of New Jersey, who has made a careful study of this insect.

#### Description, Life History and Habits.

*Winter Egg Stage.* The green apple aphid passes the winter in the egg stage, these eggs being deposited by the last generation. The eggs may be found on the terminal branches sometimes on the smooth bark, but more often around the base of lateral shoots or buds. They appear as small black, shiny, oval shaped objects, resembling those in Fig. 9. Eggs are usually deposited in greater numbers than the illustration would indicate. Eggs were discovered November 22, 1904, among a colony of adult aphid on a tree near Atlanta. This is probably about the usual time for egg deposition.

*First Spring Generation.* When the buds are bursting in spring the winter eggs hatch into minute lice. When born

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\*N. J. Exp. Sta. Bul. No. 143.



**FIG. 9.**—Winter Eggs of Green Apple Aphis. (After Dr. W. E. Britton, 3rd Report of State Ent. of Conn., 1903).



**FIG. 10.**—Apple Twig infested with Green Apple Aphis. (After Dr. W. E. Britton, 3rd Report of State Ent. of Conn. 1903.)

the lice are provided with six large, fleshy legs, rather awkward to manage, stout antennae or feelers, a piercing beak and small eyes. They commence at once to feed on the opening buds. On March 16, 1904, two aphids were found among a great number of eggs on a tree at Tulip, Ga. Although this is the only authentic record we have, it may prove to be about the average time for the eggs to hatch in spring. The exact time will vary with the seasons, whether early or late.

It should be stated here that aphids feed entirely on the plant juices which they pump up through their sucking beak. It has often been observed that plant lice take great quantities of food, much more in fact than they can assimilate. The result is that drops of liquid are constantly coming from their bodies, either through their honey tubes, of which there are two on the upper posterior end of the abdomen, or through the anal opening. This liquid is greatly loved by ants, which are nearly always found running over the aphid colonies. It is a great mistake to think that ants feed on the aphids. Instead they feed on the honey dew secreted by the aphids, and ants never injure the insects. In fact, certain species of aphids are dependent on ants, which have been known to take care of the eggs, placing them in a protected place during winter, and also to carry the aphids to favorable feeding grounds.

This honey dew is also responsible for the black, sooty fungus growth which is nearly always very noticeable when aphids are present. The fungus thrives on the honey dew and when abundant it helps to clog the breathing pores of the leaves, resulting in their turning brown, withering, and dying. This sooty fungus may be quite injurious on leaves not actually infested by aphids, because of the honey dew from colonies of aphids dropping in abundance on the foliage beneath.

Returning to the aphid hatching from the eggs: We now find them increasing rapidly in size. Each stage of growth is marked by a molt, that is, the skin is shed. This molting occurs five times in the fifteen days before the insects reach maturity. All the individuals of the "egg generation" are called "stem mothers" and each one is capable of giving birth to living young for a few days, at the rate of 8 or 10 a day. The "stem mothers" are about one-twelfth inch in length, bright green in color, and somewhat pear shaped. None of these aphids show signs of developing wings, and none are true

males or females. In reality they are non-sexual, "agamic" females, producing living young by parthenogenesis, that is, without union with the male sex.

*Second Generation.* At fifteen days of age the stem mothers give birth to young of the second generation. And now the development is quite different. As before there are five molts, but these occur at shorter intervals and the aphids of the second generation become adult in 8 or 9 days. It is also noted that after the third molt the individuals begin to differ in appearance. About three-fourths show indication of the development of wings. At the fourth molt the wing pads are well developed and at the fifth and last molt the adults appear with a pair of well developed wings. The remaining one-fourth develop wingless, much like the stem mother. The winged form is slightly smaller than the parent, but the wings expand nearly one-fourth inch. These individuals are also green in color, but appear darker, almost black.

We now have what we may call the migratory form.

The winged individuals fly to other trees, or to other limbs of the tree on which they were born, and there start new colonies. Young are brought forth alive by non-sexual, agamic, reproduction as before. Thus we see how colonies may appear in several places in an orchard, apparently simultaneously.

The wingless adults of the second generation remain in the original colony and commence to produce young, of which less than one-half develop wings and when adult migrate to start new colonies.

*Third Generation.* We understand now that we have adults, both winged and wingless, of the second generation, and their young will constitute the third. Dr. Smith states that the young of the winged forms never develop wings, but mature wingless, and that all of the broods throughout the summer thereafter are wingless. As mentioned above, about one-half of the young of the second generation of wingless adults develop wings and migrate. By this time the original colonies, if not disturbed, will have become very numerous, and their damage to the foliage will be quite apparent.

*Succeeding Generations.* After the winged adults of the third generation, it is not believed that any more winged forms appear. During the summer the aphids continue to re-

produce parthenogenetically through ten or more generations. As each agamic female gives birth to at least forty young, and each one born is capable after nine days, of producing the same number, it is not surprising to note the rapid increase of the insects.

*Last Generation.* The last of the season's generations develop into true males and females. After mating the females deposit fertilized eggs which remain on the trees during winter, and hatch and develop into "stem mothers" the following spring.

### REMEDIAL MEASURES.

Now that it is understood how the aphids develop and increase during summer, the reader will be in a position to judge about when remedies should be applied. It is useless to attempt to use arsenical poisons, hence the only chance of killing the insects by spraying is to use some solution that will kill by contact, or fumigation with some poisonous gas. For orchard trees the latter is impossible. Contact poisons, such as kerosene emulsion, ~~whale~~ oil soap solution, tobacco decoction, etc., will be found effective if the insects are actually touched by the mixture. All insects breathe through pores in the body wall, so that if these pores can be closed the insects will die from suffocation. Kerosene acts in this way. Tobacco and whale oil soap solutions tend to suffocate, but they also kill by their direct caustic action on the soft bodies of the insects. In practice in Georgia it has been found that tobacco decoction is more efficient than kerosene emulsion even when the latter is used at 15 and 20 per cent. This may be due largely to the fact that the fine hairs on the apple leaves tend to keep the mixture from the bodies of the insects. And here we find an argument for recommending spraying just as the buds are opening. At that time the insects are not protected, either by the curled leaves, or the plant hairs.

Referring to the life history again we find that it requires fifteen days for the first generation to mature, and at least nine days more before the first winged adults appear. Hence after the eggs hatch in spring the apple grower has about twenty-four days to kill the aphids and still prevent the winged forms from flying to other trees to establish new colonies. In other words, if the aphids are killed entirely, within twenty-four days after the first eggs hatch, spread of the species will

be entirely prevented. In practice it will be found almost impossible to exterminate the apple leaf aphid. Some few individuals will escape the most thorough spraying. But if the apple grower will spray twice in succession, first about ten or twelve days after the eggs hatch and again five or six days later, the aphid will be so reduced in numbers as to be prevented from causing much injury.

#### **Tobacco Decoction.**

Tobacco stems, or <i>fresh</i> tobacco dust-----	3 pounds
Water -----	5 gallons
Boiled together for at least-----	2 hours

The above is the formula we recommend, though we understand that some apple growers have used only 2 pounds of stems to five gallons of water. Mr. H. R. Staight, of Demorest, an enterprising apple grower, has had success with the latter strength. The tobacco decoction may be used without injury to trees. Young trees or nursery stock may be treated by bending the tops over and dipping them in a bucket of the decoction. Larger trees must be sprayed.

#### **Kerosene Emulsion.**

This is made according to the directions given on page 23 and may be applied at 15 per cent. strength. Undoubtedly this emulsion will kill all the aphid that it touches, but in practice it has not proved as successful as the tobacco decoction. It will be found more useful for destroying aphid on the opening buds, when the plant hairs do not prevent its reaching the insects, than later when the leaves are developed.

#### **Soap Solution.**

Any strong potash soap is quite effective when used at the rate of 1 pound to 3 gallons of water, and applied the same as tobacco decoction. A tobacco potash whale oil soap, now sold by James Good, 939 North Front St., Phila., Pa., has proved to be quite effective in work done by Dr. Smith of New Jersey. "Takanap," a soft naphtha soap, manufactured by Thayer-Hovey Soap Co., Darby, Pa., has been recommended as a remedy for plant lice, and may be worth testing. Strong home-made potash or lye soap, if used persistently, will prove to kill the apple leaf aphid wherever they are reached by the spray.

## WHEN AND HOW OFTEN TO SPRAY.

Apple growers will have to judge by the opening buds or by the appearance of the insects themselves, just when the first spray for aphid should be applied. If the grower will learn to discover the eggs during winter, and watch in spring for the first young, the proper time may be ascertained. Needless to say the first spraying should be done within a few days after all the eggs hatch. On March 16, 1904, at Tulip, Ga., the writer found two aphid among a number of unhatched eggs. This date may be taken as an indication of the average date of hatching, but the exact date will vary in different seasons.

Winter spraying to destroy the eggs has not proved successful. Thorough fumigation of nursery stock with hydrocyanic acid gas will usually kill the eggs that may be on the trees when fumigated. For orchard trees it is not practicable to attempt to kill the eggs unless the twigs bearing the eggs are cut off and burned.

The first spraying after the eggs hatch should be followed by a second application five or six days later, unless examination shows that all the aphid have been killed by the first treatment.

When migratory colonies appear in the orchard or nursery during summer, the trees should be sprayed with tobacco decoction, or one of the remedies mentioned above. If the trees are overlooked until the leaves have become curled from the work of the aphid, it may sometimes be necessary to pull off the worst infested leaves by hand and spray those remaining. Usually it will be best to spray a second time, five or six days later. Remember that the spray must come in contact with the insects, and if the curled leaves prevent this they should be removed by hand. If apple growers will learn to fight the apple leaf aphid intelligently, much injury may be prevented.



## NOTICE.

The bulletins of the Georgia State Board of Entomology, which are of present practical value, and still available, are mentioned below. (The numbers not mentioned are either out of date or exhausted.) Application for any of these numbers should be addressed to the State Entomologist, Atlanta, Ga.

Bulletin No. 6—The Peach Leaf-Churl and its Treatment.

Bulletin No. 9—The Cotton Caterpillar.

Bulletin No. 11—Fumigation of Nursery Stock.

Bulletin No. 12—Mexican Cotton Boll-Worm.

Bulletin No. 13—Some Common Insects Injurious to the Apple.

Bulletin No. 14—Experiments With the San Jose Scale in 1904.

Bulletin No. 15—Cyanide Method of Fumigating Nursery Stock.

Bulletin No. 16—Cotton Boll Worm and Insects Injurious to Corn and Truck Crops.

Bulletin No. 17—Peach Insects, a treatise on the important Peach Insects in Georgia.

Bulletin No. 18—Pear Blight Disease in Georgia, and Pear Leaf Blight.

Bulletin No. 19.—Insecticides and Fungicides: When and How to Spray.

Bulletin No. 20—Part I. Report of State Entomologist for 1905. Part II. Crop Pest Law and Regulations.

Bulletin No. 21—Spraying To Control the San Jose Scale.

Bulletin No. 22—Black Root Disease of Cotton.

D. G. 552.35

# GEORGIA

## State Board of Entomology

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BULLETIN No. 24—JUNE, 1907

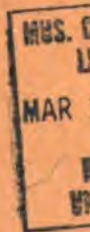
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### Cotton Anthracnose, AND Cotton "Rusts,"

(Red Rust, Black Rust, Angular Leaf Spot, E

BY

A. C. LEWIS, Ass't Entomologist.



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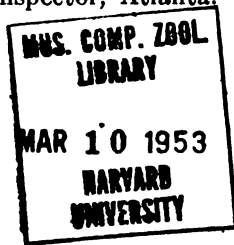
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# **BULLETIN**

OF THE

## **Georgia State Board of Entomology.**

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**JUNE, 1907.**

**No. 24.**

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Published by the Georgia State Board of Entomology, Atlanta, Ga., and sent free of charge to all residents of the State who make request for same.

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### **COTTON ANTHRACNOSE.**

BY  
**A. C. LEWIS.**

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#### **INTRODUCTION.**

The fungous disease of cotton known as Anthracnose, was so prevalent and widely distributed over the State during the summer of 1906 and did so much damage, that we deem it advisable to issue at this time this bulletin describing the disease and giving suggested methods of combating the same. From a study of the illustrations and the written description it is hoped that the cotton planters may be able to recognize the disease should it occur in their cotton fields this year or during seasons in the future. We found during the summer of 1906 that many planters mistook the cotton anthracnose for the work of some dreadful cotton insect, and became greatly alarmed, fearing that the cotton boll weevil occurred in their fields. Hence in the following pages the author has tried to describe the cotton anthracnose, and also the work done by some sucking insects, so that the planter may be able to tell which of these pests he has to contend with and govern his farming accordingly.

While it may be too late now to save this season's crop—1907—from attack and subsequent loss by the disease, the planter, by preparing now to select seed may be able to largely prevent or lessen the loss from this disease next season. From the time the cotton begins blooming to the end of the season will be a good time to make selection of plants from which to save seed for planting next season. This phase of the disease

is discussed more fully under remedies, for which consult page 59.

Those who have a number of varieties of cotton planted should make careful observations during the summer to see if there is any variety that is free or more resistant than others to the disease. Hence it will be seen that during this season is an opportune time to begin fighting this disease for the future.

### DISTRIBUTION OF THE DISEASE.

As mentioned above, this fungous disease of cotton was very general throughout the State during the summer of 1906. The writer visited affected fields in the following counties: Dooly, Early, Harris, Marion, Muscogee, Randolph, Sumter, Stewart, Taylor, Webster and Worth. Specimens of the disease were received from the following counties: Baldwin, Bulloch, Butts, Berrien, Coffee, Douglas, Elbert, Houston, Johnson, Miller, Quitman, Pulaski, Talbot, Troup, Walton and Washington. From this it would appear that, without doubt, it was present to a greater or less extent in every county in the State where cotton was raised.

We were also informed that cotton anthracnose was present in Alabama during 1906. The writer has also seen the disease in Oklahoma and Texas. The disease is probably widely distributed throughout the different cotton growing states, but does not, as a rule, do much damage except in certain localities, or in a year favorable for the development of the fungus causing the disease.

The loss in Georgia from cotton anthracnose during 1906 was very great. Many of the letters we received stated that over one-half of the bolls in certain fields were affected. In many of the fields visited by the writer from 10 to 50% of the bolls were affected. The disease was quite general also in the counties visited—not being confined to a few small spots in a few fields. In 1905, on the other hand, this disease did but very little damage in Georgia, appearing only in small areas in a few isolated fields.

### PRESENT OUTLOOK.

This fungus being a plant of a low order requires as do other plants certain weather conditions for its best development. These ideal weather conditions we had in the wet season of 1906. The fungus now present in the soil will be likely to do some damage this season even if the weather conditions are

not so favorable as they were last year for the growth of the fungus. If we should have another wet season the anthracnose would be almost sure to be at least as severe as it was last season. Hence it is important that everything be done to prevent or lessen the severity of the disease, so that should another season occur in the future favorable to the disease the loss may be reduced to the minimum.

### DESCRIPTION OF THE DISEASE.

Anthracnose affects the bolls principally, and causes them to rot and decay. It first appears on the bolls as minute specks



**Fig. 1. Anthracnose. Early stage of, on Nearly Mature Cotton Bolls.**  
(After Photo by Wilmon Newell.)

which look very much like insect punctures. But unlike insect punctures they continue to grow in size until some times one-half or two-thirds of the boll is covered. The writer has observed some cases where the disease seemed to start on the boll in a water colored blister which later became depressed and dark brown in color. The color of the diseased area varies with the age, becoming a darker brown for a time until the

spores are produced, when they have a pink center and border. Later the diseased area may be overgrown with a white fungus and the pink color will be apparent throughout the diseased area. At first the small brown spots enlarge in every direction, but if numerous they soon coalesce and become irregular in outline. As soon as the fungus reaches the cotton in the boll it spreads very rapidly and the cotton soon turns black and rots. This happens very frequently when the diseased area is no larger around than a lead pencil. When young bolls are attacked they frequently rot and shrivel up. Such bolls never open, or at least only slightly at the apex. Sometimes only one or two of the carpels of a boll are affected but even then the boll does not open normally. The different stages of the disease are well shown in Figs. 1, 2, and 3. In Fig. 3 the manner



Fig. 2. Anthracnose. Showing its Spread on Small Bolls. Notice development of white stage of the fungus.  
(From Photo, Original.)

in which the diseased bolls open and the different degrees of destruction are well shown. It will be seen that all the cotton is destroyed in the boll in the center, in the others all but one lock. Hence it will be seen that the disease destroys many bolls completely, and many more partially. Cotton may be picked from these diseased bolls and the lint and seed in such a case is very liable to be covered with the spores of the fungus. This will again be referred to under remedies.

The author has never found the disease on stems of mature plants, but according to Prof. Atkinson,\* it is sometimes found on mature stems where they are wounded, or at the leaf scars. The disease, however, very frequently attacks the stems of young cotton causing them to wilt and die.

\*The Cotton Plant Bul. No. 33, Office of Exp. Sta. U. S. Dept. of Agr.

Anthrachnose also attacks the leaves of the plants, and especially the sickly or weak ones. Prof. Atkinson also found that the cotyledons or seed leaves suffer from a characteristic injury probably caused by the spores that remain on the lint germinating and attacking the cotyledons as they slip through the seed hull and adhering lint. On the fleshy cotyledons the diseased area has the characteristic pink color that is found on the diseased bolls.

### CAUSE OF ANTHRACNOSE.

This disease, Cotton Anthracnose, is caused by a fungus, *Colletotrichum gossypii* (Southworth) which attacks the bolls, leaves, cotyledons and sometimes the stems of young plants, causing the bolls to rot as described in a previous paragraph.



Fig. 3. Cotton Bolls Nearly Destroyed by Anthracnose. Showing how the bolls are prevented from opening normally. Lint all destroyed except in one or two locks. (From Photo, original.)

The life history and botanical character of this fungus have been studied and described by Miss Southworth,\* and Prof. Geo. F. Atkinson.† The fungus has been isolated, grown on different media, and inoculations made, so it has been proven beyond a doubt that the disease is caused by the fungus mentioned above.

The question as to just how the fungus grows upon the plant through the summer is not yet definitely settled. Prof. Atkinson failed to find the fungus in all parts of the plant. He thinks there is no evidence to show that the fungus grows in

\*Jour. of Mycol., Vol. 6, No. 33. 1890-91, p. 100.

†The Cotton Plant, Bul. 33, p. 293, Office of Exp. Sta., U. S. Dept. of Agr.

the stem and up to the leaves and the bolls. From the evidence at hand he thinks it very possible that the spores may grow on the diseased leaves and at the leaf scars, producing spores at frequent intervals, and in this manner keep the fungus alive until the bolls appear on the cotton stalks. We understand that Prof. R. J. H. DeLoach, Botanist for the Experiment Station, at Experiment, Ga., is working along these lines now, hence we hope to hear something further on these points in the future.

## RELATION OF INSECTS TO THE DISEASE.

Many reports came out in different papers during the season of 1906, stating that the boll weevil, or some kind of cotton insect was destroying the cotton bolls. All of these reports that we investigated proved to be anthracnose and not the boll weevil or any other cotton insect. In fact, no cotton insect was found except the boll worm, and a brown bug, *Calocoris rapidus*, a few large green soldier bugs, *Nezaria hilaris*, and these only in very small numbers in a few places. In no instance were they numerous enough to do any great amount of damage; but in many of the fields, in nearly all of the rotten bolls, there were found a number of small beetles. These were the insects that the cotton planters always pointed out as the ones that were causing the damage. During the examination by the writer, of many fields of cotton in different parts of the State, these beetles were never seen feeding or breeding in sound cotton bolls. They were always found feeding and breeding in the diseased and rotten bolls. They seemed to follow and not precede the rot. Hence it is thought they did not cause or even start the disease. After a boll has been partially destroyed they take possession of the interior, feeding and laying eggs in the decaying cotton in the boll. Some of these beetles were sent to the Bureau of Entomology, Washington, D. C., where they were identified by Dr. F. H. Chittenden as *Carpophilus dimidatus*, a beetle very frequently found breeding in diseased cotton bolls.

The injury from bugs such as those mentioned above, the Cotton Leaf Bug, *Calocoris rapidus*, and the Green Soldier Bug, *Nezaria hilaris*, is readily distinguished from anthracnose. The wounds made by these bugs become depressed and turn dark, as does the anthracnose in the early stages, but they do not continue to spread like the anthracnose spots. And upon microscopic examination the fungus is not found to be present. This of course is the crucial test and the only reliable one. Small

bolls if punctured many times by insects, very frequently dry up and drop off without rotting. Larger bolls if punctured



Fig. 4. Cotton Boll Showing Punctures of *Calocoris rapidus*. Also shows the unequal growth of the boll. (After Sanderson, Bul. 57, U. S. Department of Agriculture, Bur. of Ent.)

many times, in one or two locks, or on one side, develop one-sided, as shown in Fig. 4. Sometimes where the insect injury is very severe the bolls become soft and mushy inside, but do not rot in the same manner as the bolls affected with anthracnose. In Texas in 1904 the writer saw a number of fields that were very much affected by the browncotton leaf bug, *Calocoris rapidus*, and the effects were in every case as mentioned above. But strange to say, many of the planters there thought the injury was due to anthracnose. To determine this point beyond a doubt Prof. E. Dwight Sanderson, who was then Entomologist in Texas, had some of the bolls sent to Dr. A. F.

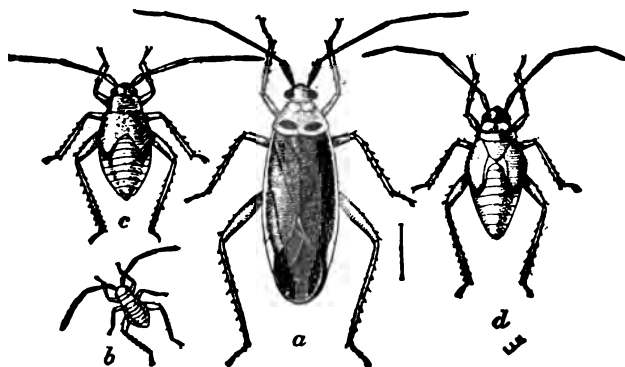


Fig. 5. Brown Cotton Leaf-bug, *Calicoris rapidus*: a, mature bug; b, young nymph; c, fourth stage of nymph; d, fifth stage of young. (After Sanderson, Bul. 57, U. S. Department of Agriculture, Bur. of Ent.)

Woods, Pathologist of the Bureau of Plant Industry, U. S. Dept. of Agriculture, who reported: "These resemble somewhat the

early stages of anthracnose, but we have been unable to find any fungus present, and the spots have not enlarged or developed any fungus even after several days in a moist chamber."\* The bug that caused this injury is shown in Fig. 5.

The writer, during the season of 1906, made a microscopical examination of a number of diseased bolls in different stages of the disease. These examinations failed to reveal any injury from insects, even in the smallest brown specks, which many planters thought to be punctures made by insects. But in each and every case the fungus was present. Furthermore, from observations made in the field, it was found that one of these little brown sunken spots developed in from 24 to 48 hours

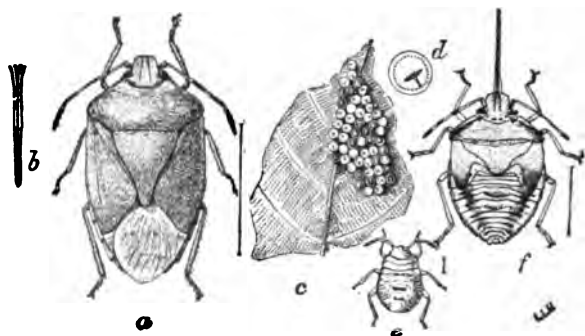


Fig. 6. Green Soldier-bug, *Nezara hilaris*: a, mature bug; b, beak of same; c, egg mass; d, single egg; e, young nymph; f, last stage of nymph;—all enlarged.

(After Sanderson, Bul. 57, U. S. Dept. of Agr., Bur. of Ent.)

into a spot as large around as a quarter or half-dollar. And in from three to four days two-thirds to three-fourths of the boll would be covered. So from watching these spots one may determine very accurately whether cotton bolls are affected by insects or with the anthracnose.

The writer also made some inoculations of healthy bolls by puncturing them with a needle which had been stuck into a diseased boll, and also by rubbing a diseased boll against a healthy one. In each case the bolls took the disease. On the ones that were punctured the disease developed quickest, but the others finally developed the disease. This shows that the fungus can, under favorable conditions, succeed unaided in attacking and destroying a boll of cotton.

From these facts, mentioned in the above paragraphs, and from observations made in many fields in different parts of the

\*Bul. 57, Report on Miscellaneous Cotton Insects in Texas, p. 45, Bur. of Ent., U. S. Dept. of Agr.

State, the writer believes that insects play no part whatever in causing anthracnose, aside from the possibility that certain ones may aid in spreading the disease from one boll to another, or from plant to plant by carrying the spores on their feet or beaks. Biting or sucking insects would be likely to inoculate healthy bolls when feeding on them after feeding on bolls affected by anthracnose. No fields were visited during the season of 1906, where insects were numerous enough in the cotton to account for the rapid spread of the disease. We believe this rapid spread was due to some other cause, but just what, we cannot say at present. It is probable that the weather conditions, together with insects and the wind, were among the most active agencies to spread the disease so rapidly, but these are points that future investigations may solve.

### SUGGESTED REMEDIES.

From the nature of the anthracnose disease nothing feasible can be done to check it in late summer or fall, but certain methods, if carried out, may tend to greatly reduce the severity of the disease the following season. At its first appearance in a field the affected bolls might be picked off by hand. This would probably check the disease for a time, but as it would be such a big undertaking it is doubtful if it would pay. If one had a choice patch of cotton that one was growing for seed this method might be followed with profit.

Spraying the cotton with Bordeaux before the disease gets a start might check it to a great extent. Anthracnose on grapes—a disease caused by a closely related fungus—is controlled by spraying with Bordeaux. But on account of the cost of this operation, and for the reason that, to be most effective, the spraying would have to be done before the disease appeared upon the cotton, it is doubtful if this method would be feasible, even if it would control the disease. A farmer would not want to go to the expense of spraying a field of his cotton without knowing whether it was going to have the disease or not, and if he waited until the disease appeared it is doubtful if the spraying would do any good. Hence it must be admitted for the present at least, that this disease must be controlled by some other method.

### SELECTING SEED FROM RESISTANT PLANTS.

From the fact that in a badly diseased field some stalks will be found on which the bolls are free from anthracnose, or

more so than the rest of the stalks, it would appear that by selecting these resistant stalks for seed we may secure a resistant strain of cotton. When it is remembered that the fungus causing the disease gets onto the lint and seed, and may infest the young plants as they are coming through the lint, it will be seen why it is important that seed be saved only from plants that are free or nearly free from the disease. By selecting a number of these resistant plants and saving the seed from each plant separately, and each succeeding year making still further selections it is believed that, after a few years, we may develop a strain of cotton that will be very resistant to anthracnose.

We know of no experiments of this nature having been tried with cotton anthracnose, but encouraged by the promising results we have secured with the black root disease of cotton, we saved seed during the summer of 1906 from some resistant plants. This seed has been planted and in due time when the results have been secured a report will be made upon the work. But in the meantime we would like to get the planters interested in this work so they will take up this subject of improving the cotton seed for themselves. Even if this method does not secure a resistant strain of cotton it will pay by improving the cotton in other particulars. Cotton from seed that is free from the spores of the anthracnose fungus will not become infested as it is coming up, as it might be from affected seed.

If any farmer does not want to take the time to save seed from his own field, which may be badly affected with anthracnose, he should look around to see if any of his neighbors fields are free from the disease. If any such are found it would be well for him to secure his seed from them for next year. He may find such a field within a few miles of his own and he might well arrange to get seed from such fields for next year's planting. For a little time spent in looking around he may be well repaid. Unless resistant plants are selected for seed, no seed from a diseased field should be planted.

If affected fields are to be planted in cotton the next season, it will be best to destroy the cotton stalks as soon as the cotton is gathered. In large fields the cotton stalks could be plowed out, raked up and burned. This would destroy the diseased bolls with the fungus and spores that would be a source of the disease the next season. If the diseased stalks and bolls are not destroyed, they might leave so many spores in the field that even if clean seed were planted the cotton might be affected

when young, and thus all or a large part of the benefit to be derived from planting clean seed would be lost.

#### POSSIBLE RESISTANT VARIETIES.

From observations made during the summer of 1906 it appears that some varieties are more subject to the disease than others. This was noticed especially at Lumpkin, Ga., on Hon. R. T. Humber's place. In one field where the Floradora and Jackson cotton were planted side by side the Jackson was not nearly as badly affected as the Floradora. And the same condition of affairs, though not so marked, was noted in different fields where the Jackson and other varieties were planted side by side. Hence it appears that the Jackson cotton may prove to be resistant to anthracnose as well as the black root disease of cotton. This and many other points we hope to solve through the experiments we are now carrying on. To determine a point of this nature may take several years observation and study. But the mere fact that in 1906 Jackson cotton did not take the disease as severe as most of the other varieties is promising and seems to show that this or some other variety of cotton may prove to be at least partially resistant to the cotton anthracnose. If we could find a variety that year after year was partially resistant to the disease it would be a great thing for the cotton planters of the State.

#### ROTATION OF CROPS.

On account of the nature of anthracnose rotation of crops will be very beneficial as a means of control. It will serve to starve out the fungus, by not supplying it with any food plant upon which to grow. Observations made in the summer of 1906 also confirm the above statement. It was found that the disease, as a rule, was not near so severe in cotton fields following corn and other crops. While such fields were not free from the disease last season, they were from 25 to 50% better than adjoining fields that had been in cotton for a number of years. In ordinary years the damage to such fields would in all probability be very light, as compared to that on the other fields that had been in cotton continuously for a number of years.

#### TREATMENT OF SEED FOR PLANTING.

Treating the seed before planting, to kill the spores, has been tried in a small way by Prof. Atkinson. But as will be seen from his report which follows, without very promising

results. "In cultures of young plants in sterilized soil annoyance was sometimes caused by the development of the fungus under circumstances such that they could have been diseased in no other way than from spores which remained attached to the seed. Several times during the winter of 1892 and 1893 cotton seed from Alabama was planted in the forcing house and botanical conservatory of Cornell University, and the fungus appeared sufficiently to damp off and disease several seedlings. This seed, which was gathered in the season of 1892, afforded a good illustration of the vitality of the fungus. Some of these seed were planted during the winter of 1893-94 and the fungus appeared upon the stems of the young seedlings. In all cases where the seed were scalded before planting the fungus did not appear. The anthracnose spores were not found in the lint in these experiments, and it may be some as yet unknown reproductive body accompanying the seed which will retain its vitality for such a long time. The anthracnose spores have been found to germinate when taken from the diseased bolls after five months. In trials of some seed from the same bolls at seven months the spores failed to grow. It is quite possible that the mycelium may rest in the tissues of the seed, as in the case of the bean anthracnose, *Colletotrichum lindemuthianum*, and probably scalding the seed would not kill the mycelium within the tissues without also killing the seed, although this treatment might partially prevent the disease."\*

From the above it appears that the spores may live over six months, and that young cotton may get the disease in some cases from seed one and two years old. Scalding the seed might kill the spores but probably would not kill the mycelium within the tissues of the seed. Here, it will be seen, are more points that need further experimenting to determine if the seed may be treated in some way with something to kill the spores and other reproductive bodies, if they are present.

\*Geo. F. Atkinson, Bul. 33. p. 295. The Cotton Plant, Office of Exp. Station, U. S. Dept. of Agriculture.

## "COTTON RUSTS"

*Red Rust, Black Rust, Angular Leaf Spot, Etc.*

The disease commonly called Cotton Rust is not a true parasitic disease, being due to physiological causes accompanied by several facultative fungi, such as *Macrosporium nigricantum*, *Alternaria* sp. and *Cercospora gossypina*, Cooke, and sometimes other fungi of a similar nature. A facultative fungus is one that may be saprophytic or parasitic under varying conditions. For instance, the fungi mentioned above are not the primary cause of the disease, but when the plant becomes weakened from lack of plant food, or under the influence of unfavorable weather conditions, they then hasten the destruction of the plants. This disease is in no sense of the word a rust properly speaking, not being at all like rust of wheat, except that in some stages the cotton at a distance looks red, or black and rusty. This is probably the reason why the cotton planters call the disease rust, and some of them also call it red rust or black rust. But as the majority of the cotton planters call all of these leaf troubles "rust" they and others who read this will understand what is meant by cotton rust when the term is used in the following paragraphs.

### DESCRIPTION OF THE DISEASE.

The disease commonly called cotton rust, being caused by a combination of unfavorable conditions, as mentioned above, is rather hard to describe in a general way. The nature and appearance of the leaves vary somewhat according to which fungus of the ones mentioned above is predominant in the leaf. To surmount this difficulty we will give a brief description of each.

### YELLOW LEAF BLIGHT AND BLACK RUST.

(*Macrosporium nigricantum*-Atk.)

In this as in nearly all cases of the different diseases caused by lack of proper nourishment, the leaves at first turn yellow. The yellow at first appears in small areas between the veins of the leaves. As the disease increases the yellow color keeps spreading until the whole leaf is more or less yellow. Soon this yellow area is marred by the growth of some fungus on the leaf.

When the fungus is the *Macrosporium*, mentioned above, the spots are round and brownish and they increase in size centrifugally. Sooner or later other fungi also attacks the leaves, generally different species of *Alternaria*. Before long the leaves become black from the hypha and spores of these fungi, and then occurs the stage which is usually called "Black Rust" by



Fig. 7. Cotton Leaf showing disease commonly called "Black Rust."  
(Copied from Prof. Atkinson's Bul. 41, Ala. Agr. Exp. Sta.)

the cotton planters. Other fungi may also attack the leaves and cause somewhat different symptoms. When the *Cercospora* stage of *Sphaerella gossypina*-Atk., is present in greater abundance than the other fungi mentioned above we have another type of the disease. When this fungus first attacks the leaf it causes little round red spots which increase in size centrifugally. In the later stage of the disease the spots become brown in the center with a red border, and in many cases the center drops out. This renders the leaves ragged and perforated so that they appear much as do peach leaves that have been attacked by the shot-hole fungus.

## "RED RUST" OR RED LEAF BLIGHT AND RED SPIDER

Quite frequently in the latter part of the season, during July and August, the cotton fields may be red or crimson with a tinge of yellow like the forest trees in the fall. This condition of the leaves the farmers generally call "red rust." This trouble is usually found on light, sandy soil that has been in cotton for a number of years. This condition of the leaves was observed in a number of fields of cotton along the G. S. & F. Ry. south of Macon. The writer examined some of these crimson leaves taken from a cotton field near Vienna. They failed to show any fungus or bacteria present. Some leaves that had about the same appearance, taken from a field near Woodbury, were examined with the same result. But at Woodbury in one field where it was thought that the cotton had the red rust, the red spider, *Tetranychus gloveri* Bks., was found to be the cause of the leaves curling up and turning red. This same spider was also found in a cotton field near Chipley. In this field, on about two acres, the damage was quite severe, causing many of the squares and leaves to drop off. The spiders being small and staying on the under side of the leaves had escaped the notice of the owner.

The red spider may be controlled as a rule, by dusting the plants with flour of sulphur, putting it on with a blow-gun in the evening or morning when the leaves are damp. Or a lime-sulphur solution may be used if a spray is desired. This may be made by using five pounds of sulphur and five pounds of lime to 100 gallons of water. Prepare by boiling the lime and sulphur in 20 gallons of water for one hour, and then diluting to 100 gallons. Apply the mixture while slightly warm. Kerosene emulsion is also used against these insects with good results. But care must be used in making the emulsion, and it must not be used at a strength stronger than 10% or the plants may be injured. (*For directions for making kerosene Emulsion send for Bul. 19.*) In using any of these sprays it must be remembered that the spiders are working on the under side of the leaves, and to be effective the spray must come in contact with them. This may be very easily accomplished by using an elbow on the end of the extension rod. Potassium sulphide solution, using one ounce in three gallons of water, is a very effective remedy for red spider. This chemical is sold under the common name "Liver of Sulphur" and may be secured from most druggists.

If one has plenty of water and a good strong pump the insects may be washed off with water. This is the method generally used by greenhouse men in fighting the red spider.

### ANGULAR LEAF SPOT.

The disease called Angular Leaf Spot derived its name from the shape of the diseased spots that appear upon the leaves.



Fig. 8. Angular Leaf-spot Disease on cotton leaf.  
(Copied from Prof. Atkinson's Bul. 41, Ala. Agr. Exp. Sta.)

They at first appear as watery green spots, but soon turn brown and later black. They grow in various shapes, but are usually bounded by the veinlets of the leaf, hence the **angular corners**

that give them their name. They grow in size, finally coalesce and form a very irregular net work of diseased spots all over the leaves. In the course of time many of the diseased areas drop out, giving the leaf a very characteristic appearance.

From the writer's observations it appears that this is a stronger parasite than the other leaf fungi described in the previous paragraphs. Sometimes the disease is found on young green leaves on both young and old plants. But this may be due to the fact that the plants are not in a healthy condition, though they appear to be so. Nearly grown or mature leaves are most liable to be affected. Very frequently the disease is found on the cotyledons or seed leaves, but does not appear until other leaves have formed above. At such time the cotyledons have performed their work, hence the disease does little or no damage, as it does not appear to attack the other leaves at this time.

These diseased spots are filled with bacteria and sometimes with a fungus, *Pseudomas malvacearum-Smith*. Prof. Atkinson\* found bacteria in these spots, but failed to produce the disease by inoculating the leaves with the bacteria. This, he thought, went to show that possibly the bacteria were unable to enter young, healthy leaves; but old leaves, or leaves on a weak plant, the fungi and bacteria were able to enter and disease. This is probably the case whether the bacteria or the fungus happens to be the first to attack the leaves.

And last we must not fail to mention that sometimes on these "rusted" leaves the cotton anthracnose fungus is found. Hence in the effort to keep the cotton plants healthy so these facultative fungi will not be able to attack them, we are also dealing a blow to the anthracnose fungus. In fact, we may be destroying one of the principal places where the anthracnose fungus is growing and multiplying before it attacks the bolls. These diseased leaves forming as it were an incubator where the anthracnose fungus is being propagated.

### SOME OBSERVATIONS ON COTTON RUST.

(*The term "Cotton Rust" is here used to include all minor diseases just mentioned*).

During the summer and fall of 1906 the writer, while traveling over the State investigating black root and cotton anthracnose, had a good chance to make some observations on cotton rust. In making these investigations a large number

\*Bul. 41, Ala. Agr. Exp. Sta.

of fields were visited in different sections of the State, thus giving a good opportunity to compare conditions in the different counties.

This trouble was found to be quite general throughout the State, especially on light sandy soils, and also on land that had been in cotton continuously for a number of years. Near Reynolds in Taylor county one field was seen where all the cotton was affected except in an area of about one-half acre in the middle of the field. The owner informed the writer that three years ago a straw stack stood there. The cotton on this area was very green at that time, September 10, while the rest of the field had scarcely a green leaf. The cotton on this area was also much taller and would yield more per acre than the rest of the field.

In this same neighborhood one field was badly affected, while a field just across the road, on the same kind of land, was in good condition. The field in good condition had been in oats the year before, the other had been in cotton continuously for no telling how many years. The owner did not know how many years it had been planted in cotton.

Around Lumpkin, in Stewart county, it was noticed that where old fence rows or old terraces had been plowed up and planted in cotton the rust was not near so severe as it was in the rest of the field. This same condition of affairs was also observed in several other counties where the rust, as a rule, was quite general.

In Randolph county, around Coleman, where the rust was very severe on the sandy soil that had been in cotton for a number of years, in the cotton fields that had been planted after oats or corn the rust was not near so destructive.

In Dooly county, near Vienna, in one field several small areas were affected very severely, while the rest of the field was free from rust. Upon investigation it was found that on these areas where the cotton was affected with rust the soil was pebbly and shallow with a hard clay subsoil close to the surface. These areas could no doubt be reclaimed by increasing the depth of the soil by proper plowing and heavy applications of barnyard manure, in connection with a complete fertilizer.

### REMEDIES FOR COTTON RUST.

These leaf troubles mentioned above are caused primarily from a weakened condition of the plant, which may be due to improper supply of plant food or poor mechanical condition of

the soil, hence it follows that the remedy lies in supplying these wants. The observations made in Alabama by Prof. Atkinson, and those made in Georgia by the writer, all go to prove that the above statement is true. We are glad to say that experiments already made in Alabama have shown that these troubles may be controlled in a large measure by using a fertilizer rich in potash. Or if the soil is deficient in humus potash with barn-yard manure or cowpeas should be used.

In these experiments made by the Station \*at Auburn, Ala., and in different parts of the State by the farmers in co-operation with the Experiment Station, it was found that the application of the following fertilizer gave very good results:

Muriate of Potash	.. . . .	50 lbs.
Cotton Seed Meal	.. . . .	120 lbs.
Acid phosphate	.. . . .	240 lbs.

This formula represents the amount used per acre.

Almost as good results were secured by substituting 200 pounds of Kainit for the 50 pounds of muriate of potash in the above fertilizer.

"Yes," some one will say, "I used a complete fertilizer and my cotton rusted." This may be true, but probably the fertilizer was exhausted or all used up about the time the cotton began to rust. On the loose, sandy soil of South Georgia we think it would be a good plan to apply the fertilizer in two applications. Use part of the fertilizer when planting and make the last application about the time the bolls begin to form. This would supply the plant with food when it needs it most, that is, when the bolls are forming. The result would be to keep the plants in a healthy condition, for a longer time than where all the fertilizer is applied at once.

The writer believes that the rust last year was due in some cases to the poor mechanical condition of the soil. And of course if the soil was in such condition so that the food supply could not be used, or such that the plants soon suffered from drought, three or four applications of fertilizer would not prevent the rust. We recommend that in the fall or winter the soil be turned over good and deep with a turning plow. We believe many of the diseases and poor crops could be prevented by this method. **The method now used by many planters of bedding in the cotton without at first turning over the soil, cannot but produce poor results if continued year after year.**

\*Cotton Rust, Bull. 99, Ala. Agr. Exp. Station.

In connection with the deep plowing and proper application of the necessary fertilizers rotation of crops must be practiced if the best results are to be secured. This will improve the mechanical and chemical condition of the soil, and also reduce the number of nematode worms in the soil. (*For a description of Nematode worms send for Bul. 22*) In a number of fields examined last year, where the rust was bad, the nematode worms were also very numerous on the cotton roots. It is a well known fact that the presence of the nematode worms on the roots of any plants cause injury to a greater or less extent. On such land, of course, crops must be avoided that tend to increase the nematode worms. These crops are: The common cowpeas, melons, cucumbers, sugar cane, cabbage, okra, collard, potato, tomato, sunflowers, gourds and peach trees. Instead of the common varieties of cowpea plant the Iron cowpea or the Soy bean.

The foregoing remarks and suggestions all point to the fact that the cotton grower of today, his crop being menaced by black root, cotton anthracnose and cotton rust, must, in order to raise cotton successfully and profitably, practice rotation of crops and selection of seed.

## SPECIAL NOTICE.

Cotton growers may make it greatly to their advantage, besides being of assistance to the State Board of Entomology, by sending specimens of diseased plants and reporting all cases of injury to cotton. Wherever cotton fields are affected by disease of any kind, or attacked by insects, we would like to receive specimens of plants or insects, or both. A letter of explanation should also be sent under separate cover giving such information regarding the injury as may be of assistance in helping us to suggest a remedy. It is against the postal regulations to send letters in packages, unless letter postage rate is paid. For that reason, specimens of cotton or other plants, mailed alone, should be plainly labeled with name and address of sender, and a letter of explanation should be mailed at the same time.

It is of the utmost importance that the cotton growers of Georgia should be constantly on the lookout for all cotton insects. This is particularly true on account of the Mexican cotton boll weevil which may reach Georgia in a few years. If this insect is discovered when it first reaches Georgia, prompt action may prevent its spreading over a large area, as it has done in Texas and Louisiana. We desire to urge cotton growers to collect all insects which, in any way resemble the boll weevil, and send specimens to the Board of Entomology to be identified. Anyone desirous of obtaining a bulletin giving illustrations and description of the boll weevil, may get same upon request.

Injurious insects or diseases affecting crops other than cotton will be gladly received and given careful attention.

All specimens of diseased plants, insects, and letters of inquiry should be addressed to the undersigned.

Respectfully,

R. I. SMITH,

State Entomologist.





## NOTICE.

The bulletins of the Georgia State Board of Entomology, which are of present practical value, and still available, are mentioned below. (The numbers not mentioned are either out of date or exhausted.) Application for any of these numbers should be addressed to the State Entomologist, Atlanta, Ga.

- Bulletin No. 6—The Peach Leaf Curl and its Treatment.
- Bulletin No. 9—The Cotton Caterpillar.
- Bulletin No. 11—Fumigation of Nursery Stock.
- Bulletin No. 12—Mexican Cotton Boll Weevil.
- Bulletin No. 13—Some Common Insects Injurious to the Apple.
- Bulletin No. 14—Experiments With the San Jose Scale in 1904.
- Bulletin No. 15—Cyanide Method of Fumigating Nursery Stock.
- Bulletin No. 16—Cotton Boll Worm and Insects Injurious to Corn and Truck Crops.
- Bulletin No. 17—Peach Insects. A treatise on the important Peach Insects in Georgia.
- Bulletin No. 18—Pear Blight Disease in Georgia, and Pear Leaf Blight.
- Bulletin No. 19—Insecticides and Fungicides. When and How to Spray.
- Bulletin No. 20—Part I. Report of State Entomologist for 1905. Part II. Crop Pest Law and Regulations.
- Bulletin No. 21—Spraying to Control the San Jose Scale.
- Bulletin No. 22—Black Root Disease of Cotton.
- Bulletin No. 23—The Apple Woolly Aphis and Green Apple Leaf Aphis, with remedies.

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GEORGIA

# State Board of Entomology

BULLETIN NO. 26. — AUGUST, 1908.

## Peach Leaf Curl, Yellows, Rosette and Little Peach.

This Bulletin Contains a Report on Experiments Conducted in  
1906 and 1907.

BY

E. L. WORSHAM and W. V. REED.



CAPITOL  
BUILDING

Atlanta, Ga.

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הרב יוסף קארו  
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GEORGIA

# State Board of Entomology

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**Fig. 1.** Two peach twigs showing leaves badly diseased with leaf curl.  
(After W. M. Scott.)



# BULLETIN

## OF THE

# Georgia State Board of Entomology

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No. 26

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### PEACH LEAF CURL.

#### General Remarks.

As will be remembered, in the spring of 1906 peach leaf curl was exceptionally severe, occurring in numerous orchards in the northern and middle sections of the State and extending farther South to an injurious extent than it has heretofore. In fact, many fruit growers whose orchards were severely affected were very much alarmed and suffered considerable loss of their crops. This, too, was the case with a number of orchardists who were familiar with the fact that spraying with Bordeaux just before the buds open in the spring was an effective remedy against curl. But owing to the limited time of the known effectiveness of spraying and the rush work at that particular season, many could not do the spraying without suffering a more apparent loss in their other farm operations. With this fact in view and the high price of copper sulphate, it was determined to make a comparative test of fall and spring sprayings with different strengths of Bordeaux together with several other spray mixtures that would likely be found satisfactory.

#### Nature of the Peach Leaf Curl Disease.

No outward signs of the presence of leaf curl are visible in the spring when the disease occurs until it is too late to be controlled for that season. The affected leaves (See Fig. 1) take on an abnormal color, become curled and much thickened and finally drop. The presence of the curl may be occasionally noted in the young twigs as in Fig. 2, making them abnormally large, but it is confined principally to leaves.



Fig. 2. a, healthy twig; b and c, twigs in which leaf curl fungus is wintering; d, twig killed by fungus. (After Duggar.)

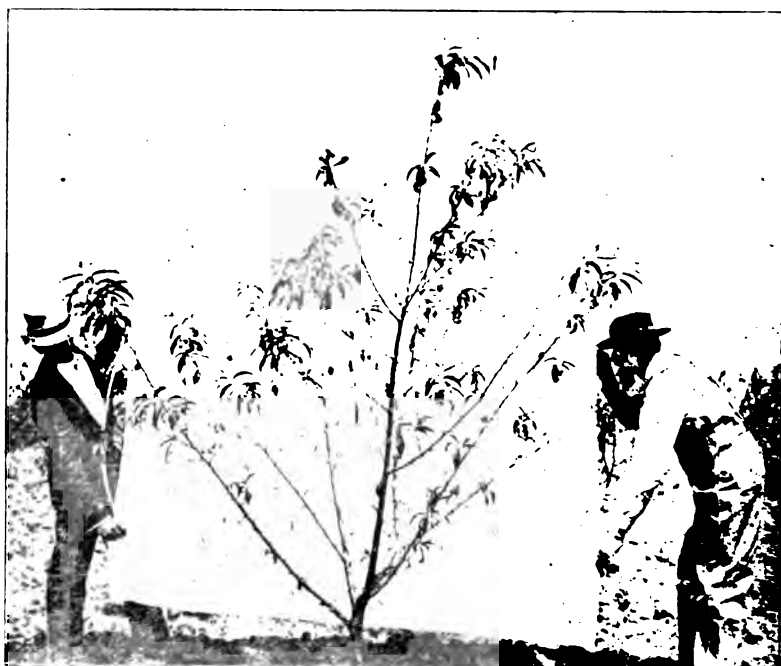


Fig. 3. Defoliation due to leaf curl.

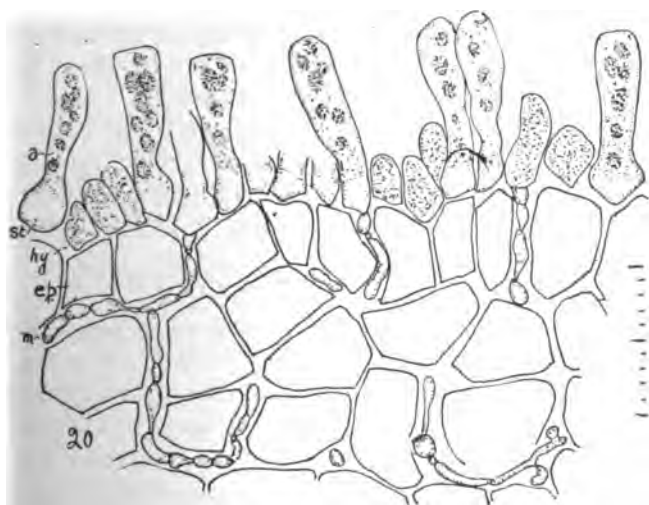
The chief damage is from defoliation of the tree. The defoliation may not result in death to the tree, but fruit is damaged or lost and the general vitality of tree is lessened. Fig. 3 shows defoliation due to leaf curl.

### Distribution.

The peach leaf curl disease is widely spread over the entire world, in fact wherever the culture of the peach is attempted. In the United States it occurs in all sections, but is more serious in the Northern and Western portions. While in Georgia the conditions are more favorable for leaf curl in the Northern part of the State, infections occurred to a serious extent in the spring of 1906 over fully two-thirds of the State.

### Life History of Fungus.

In this latitude it is usually about the first to the middle of May when the curl is most pronounced. The curled and thickened appearance of the leaves is due to a microscopic plant or fungus that lives and feeds upon the juices within the leaves, not unlike the roots of a peach tree that permeate and feed upon the plant food in the soil. (See Fig. 4).



**Fig. 4.** Section through leaf affected with leaf curl. a, ascus; st, stalk cell; hy, cells of hymenium; ep, epidermis; m, mycelium.  
(After Atkinson.)

This fungus is made up of a fine network of threads or hyphae as shown in Fig. 5. Such a mass of hyphae is called a mycelium. This fungus in attacking the cells of the plants causes them to multiply and enlarge abnormally and causes the affected parts to become very much distorted; in case of attack on leaves we have the characteristic distortions or "curls" as shown in Fig. 1.

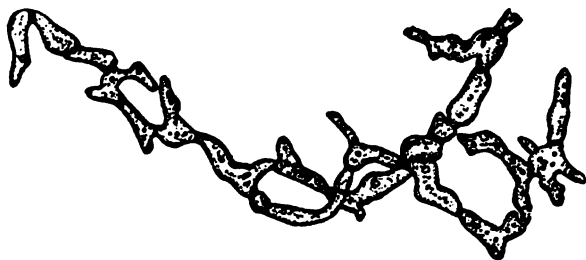


Fig. 5. Mycelium or vegetative part of leaf curl greatly enlarged.  
(After Pierce.)

On the ends of the tiny threads or hyphae making up the mycelium of the fungus are borne the sac-like bodies (asci) in which occur the minute spores which correspond to seed in higher plants. Each sac or ascus bears from four to eight spores as shown in Fig. 4.

These asci very often are produced in such numbers on the surface of the leaves as to give them a grayish, dusty appearance, and on becoming thoroughly matured liberate their spores in countless millions. These spores are then blown by the wind and lodged in all conceivable crevices in the bark and beneath the scales of the buds of the trees where under favorable conditions they germinate and form new mycelia.

#### Conditions Favorable for Leaf Curl.

Although it has been shown that leaf curl is produced from spores like higher developed plants, as corn, from the seed, the prevalent idea that it is due to cold weather in the spring is not without good foundation. Just as warmth and moisture are favorable to the germination of corn, so damp and cold weather aid in the development of the spores. Again, the peach tree being retarded and weakened in its growth by the unfavorable weather, it is more susceptible to the attacks of its parasitic host that finds the weather so advantageous to its

growth. It is frequently noted that the Northern slope or the most exposed parts of an orchard to the cold winds suffer more severely from leaf curl, and this is just what we would expect from the nature of the disease. The trees on these exposed places embody more nearly the conditions favorable to the highest development of the disease.

### Spraying Experiments.

In selecting sprays for the experiments only those mixtures that were well established for their fungicidal value were tested, and accordingly the following spray outline was formulated by Mr. R. I. Smith and tested at Adairsville by Mr. G. R. Casey and at Mount Airy by Mr. W. V. Reed. Each plat contained fifty trees or thereabout and was selected with a view to uniformity as to trees and location as much as possible. The spring spraying was an exact duplicate of the work done in the fall.

#### Plat 1. Bordeaux Mixture:

Formula—

Lime .....	6 lbs.
CuSO <sub>4</sub> (Copper Sulphate) .....	5 lbs.
Water .....	50 gallons.

#### Plat 2. Bordeaux Mixture:

Formula—

Lime .....	6 lbs.
CuSO <sub>4</sub> .....	3 lbs.
Water .....	50 gallons.

#### Plat 3. Copper Sulphate Solution:

Formula—

CuSO <sub>4</sub> .....	5 lbs.
Water .....	50 gallons.

Check Plat No. 1, containing 50 trees:

#### Plat 4. Copper Sulphate Solution:

Formula—

CuSO <sub>4</sub> .....	3 lbs.
Water .....	50 gallons.

#### Plat 5. Lime-Sulphur Wash:

Formula—

Lime .....	20 lbs.
Sulphur .....	16 lbs.
Water to make .....	50 gallons.

Plat 6. Lime-Salt-Sulphur Wash:

Formula—

Lime .....	20 lbs.
Sulphur .....	16 lbs.
Salt .....	10 lbs.
Water to make .....	50 gallons.

Plat 7. Oregon Wash:

Formula—

Lime .....	15 lbs.
Sulphur .....	15 lbs.
CuSO <sub>4</sub> .....	1¼ lbs.
Water to make .....	50 gallons.

Check Plat No. 2, containing 50 trees:

Plat 8. Lime-Sulphur Wash:

Formula—

Lime .....	15 lbs.
Sulphur .....	12 lbs.
Water to make .....	50 gallons.

Plat 9. Soda Bordeaux:

Formula—

Soda (lye) .....	1 lb.
CuSO <sub>4</sub> .....	3 lbs.
Lime .....	5 oz.
Water .....	30 gallons.

Plat 10. Soda Bordeaux:

Formula—

Soda (lye) .....	1 lb.
CuSO <sub>4</sub> .....	2 lbs.
Water .....	30 gallons.

Orchards at Mount Airy and Adairsville were selected in which to make the spraying tests on account of getting conditions very favorable to leaf curl. During the spring before the work was begun in the fall the curl had been severe in each orchard, and being located at a high altitude and exposed to Northern winds, the trees were more likely to be affected with curl the following year. The trees on which the spraying was to be made were selected at the most elevated points in the orchards where the curl had been most severe.

The spraying was begun at Mount Airy in the fall, November 16, 1906 and at Adairsville on the same date. At the

former place the spraying was finished November 19, and at the latter November 23. The spring spraying was applied the second week in February 1907 at Mount Airy and between February 11, and March 4, at Adairsville. An ordinary Gould barrel spray pump with Vermorel nozzle was used, and the spray was most thoroughly applied.

From notes made at the time the fall applications were made at Mount Airy, it was found that the work was interrupted on account of rain between the time of treatment of plat 4 and plat 5. There were frequent rains during and immediately following the time the fall applications were made, but for the sprayings which were made in the spring, weather conditions were very good.

The plats were examined at Mount Airy on May 8th, 1907 by Mr. Smith and Mr. Reed, and at Adairsville by Mr. Casey and Mr. Reed on May 21. At the time the examination was made at Mount Airy it was thought probable that the curl would be more pronounced later on, and a second examination was made by Mr. Reed on May 28th. Not much more curl made its appearance and as the results of all examinations were practically the same, we can conveniently consider them together, and the notes may be stated thus:

Plat 1. (Bordeaux, strong). Both fall and spring treatment thoroughly effective. No curl found at all on plats at Mount Airy and only an occasional leaf affected at Adairsville; no doubt due to a twig not being hit by the spray.

Plat 2. (Bordeaux, weak). Results identical with Plat 1.

Plat 3. (Copper Sulphate Solution, strong). Neither fall nor spring treatment effective. Fall spraying less so than spring treatment.

**Check Plat 1.** This check plat at Mount Airy cannot be classed as being severely affected with curl although it was present on all the trees in the plat and individual trees occasionally were severely affected. At Adairsville the curl on check plat was severe, threatening to cause the trees to drop their fruit.

Plat 4. (Copper Sulphate Solution, weak). Results similar to Plat 3.

Plat 5. (Lime-Sulphur Wash, strong). Both fall and spring treatment effective. An occasional curl leaf found at tips of twigs, due no doubt to that portion not being hit by spray, but otherwise not enough curl present to cause the spray to be classed other than effective.

Plat 6. (Lime-Sulphur-Salt Wash, strong). Both fall and spring treatment effective. By comparing with Plat 5, it was apparent that the salt did not add any value to the spray.

Plat 7. (Oregon Wash). Both treatments effective. No curl found on trees.

Check Plat 2. Located on a more exposed elevation, and consequently, curl more severe at Mount Airy. At Adairsville very bad; almost every leaf on trees affected.

Plat 8. (Lime-Sulphur Wash, weak). Results effective as were those of Plat 5 sprayed with the strong wash.

Plat 9. (Soda Bordeaux, strong). Not effective. However, from 50 per cent to 75 per cent less curl than on check plats.

Plat 10. (Soda Bordeaux, weak). Not effective. Results practically same as Plat 9.

It will be seen from the foregoing results that Bordeaux (Lime 6 lbs., Copper Sulphate 3 lbs., Water 50 gals.), is the most satisfactory spray from an economic point of view against the peach leaf curl. Particular attention should here be directed to the fact that the fall spraying controls the curl just as well as the spring treatment.

All of the Lime-Sulphur washes and the Lime-Sulphur-Salt wash were effective in controlling the curl and in case an orchard was infested with scale also, these would be the proper sprays to use as they would serve the double purpose of preventing leaf curl and controlling the scale at the same time. As stated before, the salt does not add any apparent value to the spray against leaf curl and it has already been demonstrated by the Department, as set forth in Bulletin No. 17, that it has no recognized value against scale unless it is to make the spray stick to the trees more tenaciously. This doubtful value though, is offset by the fact that the salt in the mixture causes the spray machinery to rust more severely.

One other point that might be misleading to those who wish to use Lime-Sulphur wash for curl, as demonstrated in these experiments, and for scale also, is the strength of wash to use. Our tests of the two strengths given herein for leaf curl were of the same value, but not so in their effect on the scale. The stronger the wash the more effective it is against the scale, but as there is a liability of injuring the trees by too strong an application, the 20-16-50 wash has been found by experiments to be more desirable to use against the scale, and would be advised for orchards which are treated for both leaf curl and scale.

The Copper-Sulphate solutions were not satisfactory as before indicated. The fact that the spring sprayings were more satisfactory than those made in the fall, would indicate that lime is essential in making the spray adhere. The Copper-Sulphate solutions applied to the trees in the fall, being subjected to the rains all winter and spring, were more nearly washed off the trees than those applied in the spring; hence, the less effectiveness of fall treatment. The lime in the two Bordeaux mixtures applied in the fall, on the other hand, kept the Copper Sulphate from being washed off and no difference was noticeable in the results of the fall and spring treatments.

Of the remaining two sprays tested, Oregon Wash and Soda Bordeaux, the Oregon Wash was effective, but as it has no superior advantages over Bordeaux either in convenience of preparation or the cheapness of the ingredients it contains, it has no superior commendable value.

### **Remedial Measures.**

In case orchards are not sprayed during the winter, and develop leaf curl in the spring, there is no possible way to control the disease by remedial measures, and all efforts should be directed to aid the strained conditions the trees will be left in, by stimulating their growth, if a serious amount of foliage is involved. It is always recommended that the orchard be given an extra amount of cultivation to stimulate growth in producing new leaves; a quick-acting nitrate fertilizer hoed or harrowed into the soil around the tree, will assist greatly in this direction. One-half pound of nitrate of soda to an average size tree on thin land is well adapted and recommended for this purpose.

By applying these remedial measures the present crop of fruit may be saved and the trees strengthened in developing leaves and growth to such an extent as to put on a full crop of fruit buds for another year, but otherwise, may be so badly impaired in strength as to make a fruit crop doubtful the following year. At best, remedial measures are only to meet the emergency and the tree should be sprayed the following winter to prevent a re-occurrence of the disease.

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## **DIRECTIONS FOR THE PREPARATION OF BORDEAUX, LIME-SULPHUR WASH AND OREGON WASH.**

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### **Bordeaux.**

Slake the lime carefully with enough water to reduce it to the consistency of cream and dilute to 25 gallons. Dissolve the bluestone (copper sulphate) in 25 gallons of water by suspending the crystals in a coarse sack a few inches below the surface of the water. The bluestone will dissolve more rapidly if kept in motion; or a few gallons of warm water may be used in which to dissolve the bluestone, and the solution then diluted to 25 gallons. Now take a third barrel and pour the two solutions together simultaneously by dipping up a pailful of each and allowing the streams of the two to mingle in mid-air as they are poured into the barrel. After thoroughly stirring, the Bordeaux will be ready for use. It should be thoroughly strained to prevent any foreign matter entering the spray pump to clog the nozzles.

### **Lime-Sulphur Wash.**

Add water to the sulphur and stir the mixture until it is reduced to a paste, using only enough water to break up all the lumps. Place fifteen or twenty gallons of water in a kettle, tank or boiling vat, as the case may be, and heat to the boiling point. Add the sulphur paste to the boiling water and mix thoroughly. Next add the stone lime, previously weighed out, to the boiling mixture and stir often enough through the process of cooking to keep the lime and sulphur

well mixed. In this way the combined heat of the water and slaking lime will dissolve much of the sulphur. As the sulphur goes into solution the mixture will take on a rich, brick-red color. While the lime is slaking, water may have to be added to prevent boiling over, or the steam turned off when steam is employed, though by adding only a few lumps of the lime at a time to the boiling mixture at intervals of a few minutes, further precaution will not be necessary to prevent boiling over, and will also extend the time of rapid cooking over a longer period. An excess of water more than twenty to twenty-five gallons at the outside is not desirable. After the lime is slaked, continue the boiling until the sulphur is dissolved, which will be in the course of an hour or considerably less time where the boiling is rapid and continuous.

As to how long the mixture should be cooked, much depends on the time and manner of cooking, and the operator must be guided solely by the color of the mixture. When properly boiled the Lime-Sulphur wash will be a dirty orange color with a greenish cast. No signs of the bright yellow sulphur will be present. This condition must be taken as unvarying and the boiling discontinued at this stage. By using steam a mixture of the proper color may be obtained in thirty minutes' boiling, but in a kettle over a fire, owing to the irregularity of the heat, the boiling may have to be continued for an hour or more.

When the mixture is boiled until it assumes the correct color, it is ready to be diluted to fifty gallons. This can be done either with cold or warm water. The latter, however, is somewhat to be preferred when convenient. The diluted mixture should retain its dirty yellowish-green color with no signs of the bright sulphur present. When otherwise, it is a sure indication that the concentrated solution was not boiled sufficiently.

### **Oregon Wash.**

Slake the lime in warm water. Dissolve the bluestone in warm water. Pour the bluestone solution on the slaking lime and add the sulphur also to the slaking lime. Boil one hour in 20 gallons of water, then dilute to 50 gallons and apply while warm.

### Summary.

Leaf curl can be successfully controlled by spraying with the proper sprays in the fall, as well as in the spring just before the buds begin to swell.

Bordeaux of the formula, lime 6 lbs., copper sulphate 3 lbs., water 50 gallons, is the best spray to use from an economic standpoint, for leaf curl alone.

Lime-Sulphur wash of the formula, lime 20 lbs., sulphur 16 lbs, water 50 gallons, is the most desirable in case the orchard is infested with scale.

Remedial measures after the leaf curl has appeared are only to meet the emergency and should be followed by spraying the following winter.

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### PEACH YELLOWS.\*

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This disease is American in origin and records show that it has existed for more than one hundred years. Figure 6

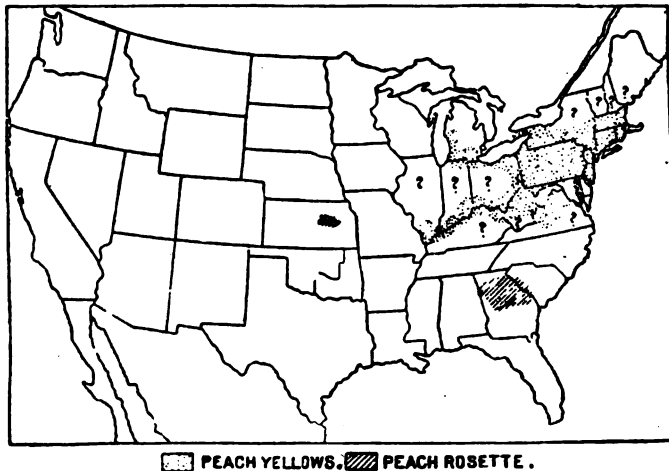


Fig. 6. Distribution of peach yellows and peach rosette in 1894.

shows its distribution in 1894, and while it probably exists in other sections, we have reports of its spread to only two

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\*Portions of the following descriptions of yellows and rosette are taken from Bulletin No. 1 of this Department, which is no longer available.

other States. Prof. Phillips, State Entomologist of Virginia, in Circular No. 4, N. S., states that it has spread to East Tennessee and West North Carolina. This shows that the disease is gradually approaching Georgia and unless the nurserymen and fruit growers give us their hearty co-operation in the enforcement of our law against yellows, there is grave danger of its being introduced into Georgia.

Fruit growing in many sections of Connecticut, Virginia, Delaware, Maryland and Michigan has been discontinued on account of yellows. Prof. Phillips claims that in one county in Virginia in 1900 there were 105,000 peach trees and at this date (1908) there are not 30,000 trees in the entire county.

In addition to peach, yellows attacks plum, nectarine and apricot.

#### Nature of the Disease.



**Fig. 7. Characteristic bushy growths occurring on limbs and trunks.**  
(After Phillips.)

If the affected tree is in bearing the first ~~symptom~~ **is** manifested in the premature ripening of the fruit, which may **take** place several weeks or only a few days before the normal season of ripening. Premature ripening may be due to other causes, but the yellows peaches bear characteristic bright-red, measly blotches over the skin and streaks of red through the flesh, often reaching the pit.

Another reliable symptom is the pushing out of newly formed buds at the ends of apparently healthy twigs or water sprouts, into short shoots with small, yellowish leaves. Such buds should not put out until the following season. Also, the disease may cause dormant buds on the trunk and larger limbs to push into feeble, often branched, broomlike shoots,



Fig. 8. Characteristic leaf and twig growth of yellows on trees one year set. (After Allwood.)

characterized by narrow, stiff leaves. (Such growths are shown in Fig. 7). Affected trees may live for three to five years, during which time they are gradually weakened and finally the foliage becomes yellowish or reddish in color. Figure 8 shows characteristic growths on trees one year set.

The term "yellows" is somewhat misleading. Quite a number of supposed cases of yellows in this State have been reported, but upon investigation the yellowing of the foliage



Fig. 9. Healthy limbs to left; two year peach tree diseased with yellows to right. (After Phillips.)

in every case proved to be due to the peach borers, drouth or some other weakening effect on the trees. Premature ripening of the fruit from similar causes has also led many to believe their trees to be affected with yellows. The absence of red spots on the skin and red streaks through the flesh of the fruit should serve to relieve uneasiness in such cases.

The cause of yellows is yet undetermined, but it is definitely known to be a disease and can be communicated from tree to tree and from orchard to orchard. Experiments have shown that it can be communicated to healthy trees through buds taken from diseased trees, but the manner of its natural spread from tree to tree is yet unknown. It is known, however,

that from scattered cases in the orchard it will gradually spread over the entire orchard and completely destroy it if left unmolested.

### **Prevention.**

It is to preventive measures alone that we have to resort for protection against yellows:

First. Trees should not be purchased from sections where yellows is known to exist. Yellows is liable to develop in such stock after planting.

Second. Pits from affected trees should not be planted. It has been demonstrated that the disease develops in trees from such pits.

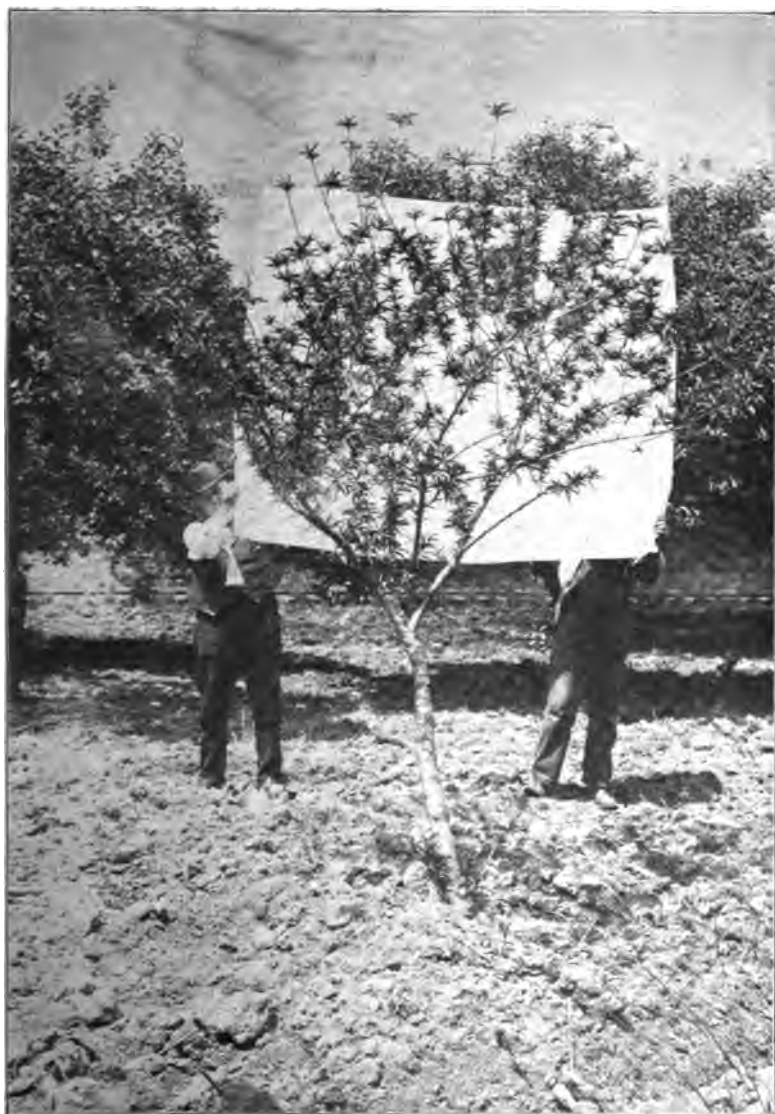
Third. Whenever the disease appears in an orchard, every affected tree should be rooted up and burned. Simply cutting off the affected parts is not sufficient. The virus exists in the apparently healthy parts and would soon develop symptoms of yellows. The whole tree, root and branch, must be destroyed.

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### **ROSETTE.**

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This disease which attacks peaches and plums is well known in Georgia. It is called rosette from the peculiar tufts into which the leaf buds grow on trees affected by it. Its distribution in 1894 is shown in Fig. 6, and we have no evidence that it has spread to other States since that time. It probably originated in Georgia and has been known to exist here for at least thirty years. The map shows it to be present in Western South Carolina and in the vicinity of Manhattan, Kansas, and it has been reported from Missouri. It probably does more damage in Georgia than in any other section for it destroys many trees each year in the infected sections of the State, but the growers do not consider it a very serious pest on account of the fact that they have been able to hold it in check by destroying all trees that are affected by it as soon as the disease makes its appearance. Trees on old hedges and in neglected orchards may sometimes serve as a source of infection for neighboring orchards. Such trees as these in a community should be carefully looked after by parties who are interested in the growth of peaches and plums.



**Fig. 10.** Peach tree affected with rosette.

### **How it Spreads.**

The cause of rosette is not definitely known, but Dr. Erwin F. Smith of the U. S. Department of Agriculture, Washington, D. C., demonstrated several years ago that it could be communicated either by bud inoculation or root grafting. He thinks it possible that the disease may enter through the roots. It is probably not spread by birds and insects.

### **How to Detect it.**

On account of a misconception of the nature of this disease, it has been mistaken by many Georgia growers for yellows. No case of yellows has ever been found in Georgia. When a tree is attacked by rosette the leaves are bunched together in characteristic rosettes and the foliage assumes a yellowish green or orange color in case of peaches, and on plums, a reddish color. The leaves are straight, more or less stiff, with in-rolled margins. A tree may or may not be attacked in all parts at once. Fruit does not ripen prematurely as in yellows but either shrivels while green and drops off, or ripens naturally. No fruit ever matures on a tree affected in all parts at once. No tree has even been known to recover when once attacked by rosette.

### **Prevention.**

It has been demonstrated that this disease can be held in control by digging out affected trees and burning them. This should be done as soon as the disease is detected on a tree.

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### **LITTLE PEACH.**

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This is a disease about which little is known. According to Dr. E. F. Smith in 1901, it had not been reported from any other State than Michigan where it is said to be more destructive than yellows. It has since been reported in New York State, and Prof. Phillips thinks it probably exists in two counties in Virginia. We have no evidence that it exists elsewhere.

This disease is somewhat on the order of peach yellows, is of the same contagious nature as yellows and rosette and is perhaps even more destructive.



Fig. 11. Peach twig showing characteristic manner in which rosettes are formed.

### **Nature of the Disease.**

In case of little peach, the peaches appear to be normal except as to size; they are much dwarfed and are insipid and bitter to the taste. The leaves, according to Dr. E. F. Smith, are "possibly one half as large and usually one third thicker than healthy leaves. They are of a sickly, yellowish, reddish or bluish-green color." The fruit does not ripen prematurely as in yellows, but ripens later than the usual time for ripening.

### **Prevention.**

In controlling little peach, we resort to the same measures employed against yellows and rosette.



## NOTICE.

The bulletins of the Georgia State Board of Entomology, which are of present practical value, and still available, are mentioned below. (The numbers not mentioned are either out of date or exhausted). Application for any of these numbers should be addressed to the State Entomologist, Atlanta, Georgia.

Bulletin No. 12.—Mexican Cotton Boll Weevil.

Bulletin No. 13.—Some Common Insects Injurious to the Apple.

Bulletin No. 16.—Cotton Boll Worm and Insects Injurious to Corn and Truck Crops.

Bulletin No. 17.—Peach Insects. A Treatise on the Important Peach Insects in Georgia.

Bulletin No. 18.—Pear Blight Disease in Georgia, and Pear Leaf Blight.

Bulletin No. 19.—Insecticides and Fungicides. When and How to Spray.

Bulletin No. 20.—Part I. Report of State Entomologist for 1905.

### Part II. Crop Pest Law and Regulations.

Bulletin No. 21.—Spraying to Control the San Jose Scale.

Bulletin No. 22.—Black Root Disease of Cotton.

Bulletin No. 23.—The Apple Woolly Aphis. Green Apple Leaf Aphis. Remedial Measures for Same.

Bulletin No. 24.—Cotton Anthracnose and Cotton "Rusts."

Bulletin No. 25.—Report of State Horticultural Society for 1907.

Circular No. 6.—The Use of Soluble Oils Against San Jose Scale.

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**DECEMBER 1908**

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# Georgia State Board of Entomology

Bulletin No. 27

December, 1908

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Proceedings  
Georgia State Horticultural Society  
1908

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and State Horticultural Society

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Herbert C. White . . . . . DeWitt

### ON SYNONYMS.

R. C. Berckmans . . . . . Augusta  
H. B. Chase . . . . . Huntsville, Ala  
G. H. Miller . . . . . Rome

## ON ORNAMENTAL AND USEFUL TREES.

Charles Deckner	Atlanta
Alfred Cuthbert	Augusta
R. C. Berckmans	Augusta
H. L. Boone	Valdosta

## ON VEGETABLE CULTURE.

N. L. Willet	Augusta
H. L. Long	Leesburg
Charles Deckner	Atlanta
Jno. A. Cobb	Americus
Charles S. Bohler	Augusta

## ON PACKING OF FRUITS AND VEGETABLES.

C. W. Withoft	Fort Valley
C. J. Hood	Commerce
W. H. Felton, Jr.	Macon
I. C. Wade	Cornelia

## ON TRANSPORTATION OF FRUITS AND VEGETABLES.

John T. West	Thomson
Willis M. Boyd	Adairsville
Geo. White, Jr.	Sparta
W. C. Stafford	Barnesville

## ON LEGISLATION.

Dudley M. Hughes	Danville
Jno. T. West	Thomson
Geo. Gilmore	Warthen
C. J. Hood	Commerce
W. H. Felton, Jr.	Macon

## FORESTRY.

Prof. Alfred Akerman	Athens
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## ON BIOLOGY.

E. L. Worsham	Atlanta
A. C. Lewis	Atlanta

# ROLL OF MEMBERS OF THE GEORGIA STATE HORTICULTURAL SOCIETY 1908-1909

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Akerman, Prof. Alfred . . . . .	Athens
Berckmans, L. A. . . . .	Augusta
Berckmans, P. J. . . . .	Augusta
Berckmans, Mrs. P. J. . . . .	Augusta
Berckmans, R. C. . . . .	Augusta
Berckmans, P. J. A., Jr. . . . .	Augusta
Boone, H. L. . . . .	Valdosta
Bohler, Chas. S. . . . .	Augusta
Boyd, Willis M. . . . .	Adairsville
Byrd, T. C. . . . .	Chester
Calloway, W. R. . . . .	Turnersville
Carroll, J. S. . . . .	Atlanta
Chase, H. B. . . . .	Huntsville, Ala.
Clark, Jno. W. . . . .	Augusta
Cobb, Jno. A. . . . .	Americus
Cobb, Mrs. Lamar . . . . .	Athens
Cuthbert, Alfred . . . . .	Augusta
Christie, S. R., Jr. . . . .	Mt. Airy
Deckner, Charles . . . . .	Atlanta
Ellis, J. E. . . . .	Turnersville
Farmer, L. R. . . . .	Louisville
Felton, W. H., Jr. . . . .	Macon
Fort, J. P. . . . .	Athens
Fleming, Jas. L. . . . .	Augusta
Fugazzi, M. . . . .	Cincinnati, Ohio
Free, J. E. . . . .	Demorest
Gilmore, Geo. . . . .	Warthen
Griffing, C. M. . . . .	Jacksonville, Fla
Henderson, W. J. . . . .	Davisboro
Hickman, T. I. . . . .	Augusta
Hunter, W. B. . . . .	Cornelia
Howard, F. E., M.D. . . . .	Atlanta
Hood, C. J. . . . .	Commerce
Hughes, Dudley M. . . . .	Danville
Hunt, B. W. . . . .	Eatonton
Hughes, D. G., Jr. . . . .	Danville
Hunnicut, G. F. . . . .	Atlanta

Jessup, W. B. . . . . Chester  
 Keller, John . . . . . Fort Valley  
 Kitchens, A. M. . . . . Baldwin  
 Lester, T. V. . . . . Fayetteville  
 Lombard, T. A. . . . . Cornelia  
 Long, H. L. . . . . Leesburg  
 Lewis, A. C. . . . . Atlanta  
 Miller, J. C. . . . . Rome  
 Miller, G. H. . . . . Rome  
 McClesky, L. L. . . . . Atlanta  
 McHatton, T. H. . . . . Athens  
 McInnes, Dr. Nell . . . . . Augusta  
 Park, R. E. . . . . Macon  
 Philbrick, C. L. . . . . Baldwin  
 Philbrick, Ethan . . . . . Baldwin  
 Reed, W. V. . . . . Atlanta  
 Ruggles, F. A. . . . . Dawson  
 Rudisill, W. P. . . . . Cornelia  
 Rudisill, J. C. . . . . Cornelia  
 Sheppard, Geo. W. . . . . Tallapoosa  
 Staight, H. R. . . . . Demorest  
 Shields, J. O. . . . . Thomson  
 Stranahan, J. J. . . . . Bullochville  
 Stockbridge, Prof. H. E., 20 Forsyth St. . . . . Atlanta  
 Von Herff, 93 Nassau street . . . . . New York  
 Waernicke, H. E., 1300 Pennsylvania avenue . . . . Washington, D. C.  
 West, Jno. T. . . . . Thomson  
 Wade, I. C. . . . . Cornelia  
 Wilcox, M. E. . . . . Mt. Airy  
 White, H. K. . . . . Sparta  
 Wight, J. B. . . . . Cairo  
 Willet, N. L. . . . . Augusta  
 White, Geo., Jr. . . . . Sparta  
 Withoft, C. W. . . . . Fort Valley  
 Whitney, C. E. . . . . Augusta  
 Worsham, E. L., State Entomologist . . . . . Atlanta

## HONORARY MEMBERS

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Alwood, Prof. W. B., Va. Polytechnic Institute . . .	Blacksburg, Va
Bailey, Prof. L. H., Dir. Cornell Col. of Agr. . . . .	Ithaca, N. Y.
Brackett, Col. G. B., Chief Div. of Pomology . . .	Washington, D. C.
*Bush, Isador . . . . .	Bushberg, Mo.
*Crayton, Hon. B. F. . . . .	Anderson, S. C.
Furnass, Hon. B. F. . . . .	Brownsville, Neb.
*Gray, Prof. Asa . . . . .	Cambridge, Mass.
Green, Mrs. C. C. . . . .	Clayton, Ala.
Hale, J. H. . . . .	South Glastonbury, Conn.
Hexamer, Dr. F. M., 52 Lafayette Place . . . . .	New York, N. Y.
Joly, Chas., V. P. National Hort. Soc. of France . . .	Paris, France
*Meehan, Thomas . . . . .	Germantown, Philadelphia, Pa.
Munson, T. V. . . . .	Denison, Tex.
Newman, Prof. J. S. . . . .	Clemson College, S. C.
Pearson, T. G. . . . .	Greensboro, N. C.
Quinn, P. T. . . . .	Newark, N. J.
*Sims, Col. R. M. . . . .	Columbia, S. C.
*Strayman, D. J. . . . .	Leavenworth, Kan.
*Thurber, Prof. George . . . . .	New York, N. Y.
*Wilder, Hon. Marshall P. . . . .	Boston, Mass.

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\*Deceased.

## PROCEEDINGS

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President P. J. Berckmans, of Augusta, called the meeting to order at 10.30 o'clock A. M.

Rev. Dr. Hoyt being absent, Prof. John N. Rogers, Supt. Tenth Congressional District Agricultural School, invoked the divine blessing for a successful and beneficial meeting.

Col. I. C. Wade, in behalf of the city of Cornelia, the Fruit Growers' Association, and the Chamber of Commerce of Yonah Land, welcomed the members and guests to Cornelia, in appropriate phrases.

The PRESIDENT: I take pleasure in introducing to you one of the oldest and most valued members, who will respond to the address of welcome, Col. John A. Cobb.

Col. Cobb's response was replete with assurances that the members of the Society were happy indeed at being enabled to attend this meeting in such a beautiful portion of our State, and cordially thanked the citizens of Cornelia for their good wishes and kind offers of hospitality.

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## THE PRESIDENT'S ADDRESS

*Members of the Georgia State Horticultural Society, Ladies and Gentlemen:*

When I first saw this part of our great State, many years ago, I found nothing but a wilderness. The city of Cornelia and the towns surrounding you did not exist; indeed, I doubt if they were thought of. At that time I was quite interested in this part of the country, and if it had not been that our railroads were in an embryonic condition, making it very difficult to get to and from this portion of the State, I would certainly have remained where I purchased the first piece of ground that I owned in Georgia. Aided by the railroads, you have developed this section to an extent that, what was then a wilderness, is to-day a paradise.

Fifty-eight years ago it was my privilege to make a month's visit to this picturesque country, and in company with the late Jarvis Van Buren, first saw some of the native apples which he and Mr. Silas McDowell, of Franklin, North Carolina, had collected. Many of these apples were gathered from trees, the seed of which was planted by the Cherokee Indians who, knowing nothing of grafting, resorted to the natural seeding method in propagating their trees. In several spots on these mountains were remnants of those trees which were unquestionably the oldest pomological reminiscences of a semi-civilized race then already departed from their ancestral homes. This country may also lay claim to two of the pioneer nurseries of Georgia, besides Mr. Van Buren, Colonel John R. Stanford, who, early in the fifties, had established a commercial nursery at Clarksville, from which many of our most valuable native fruits were disseminated. Your county was also among the first in upper Georgia to recognize the necessity of organizing an Agricultural Society. On May 6th, 1845, this was perfected by the election of James R. Wylie, as President, George D. Phillips as First Vice-president, John W. H. Underwood and Malcolm J. Walker as Corresponding Secretaries. From the three first named gentlemen I received many courtesies and information as to the possibilities of this beautiful region. It is therefore most appropriate that the Georgia State Horticultural Society should again meet, whence many of the earliest native pomological products were given to our fruit industry. Many of you have been attracted to this highly favored section, where a healthy climate and productive soil are united to one of the most beautiful regions of this Southland. You have found it wonderfully adapted to the growing of a great variety of fruits, and are thus continuing, aided with all the modern scientific discoveries, in what the Red Men followed with their primitive methods.

It is not my purpose to take up your valuable time with an elaborate address, but in having again the pleasing service to greet you, these personal reminiscences of more than a half-century ago may be found of some interest to you.

There are, however, several important matters which concern the welfare of this Society which I desire to offer to your attention.

#### STATE AID AND FINANCES.

For the past two years our financial revenue has diminished rapidly. This is owing to the gradual falling off of our membership, the causes of which must partly be attributed to indifference of those who were once our staunchest supporters. Many of our older members have gone to the Great Hereafter, but why do our younger men, whose avocations are connected with the soil's products, fail to affiliate with our organization which has been such a potent factor in promoting

the cultivation of our great horticultural resources? Every effort to enlist those to whom we look for perpetuating our work has been made, but success has not been encouraging. Let me appeal to you to help recruit our ranks, to be once more filled as they were for so many years, and let the usefulness of our association continue to remain a credit to the intelligence and refinement of our State.

For two years past we were unable to publish the catalogue of fruits, which in the past has proven to be of such great value and has been a reliable guide to our fruit-growers, especially to new beginners and prospective, desirable immigrants from other States. Our State Board of Entomology has generously come to our rescue in largely paying for the printing of the proceedings of the session of 1907. These were sent out jointly by the Board of Entomology, as Bulletin No. 25, and the Society, part of the expense of publication being assumed by the Society and the largest portion by the Board, to which, in behalf of the Society, sincere acknowledgment is herewith tendered. It is to be hoped that sufficient funds may be secured to again publish the catalogue of fruits, which has been carefully revised during the past two years and is now nearly correct as every effort has been made to perfect it.

The Society has never received a dollar of direct State aid other than above mentioned. Every plea made to the Legislature for an appropriation sufficient to publish and distribute our proceedings has been so regularly ignored that further attempt has been considered useless.

Compare the unwillingness of the State of Georgia, to aid an industry that, in thirty years, has increased its commercial fruit products from a few hundred dollars to an output of 7,000 cars of peaches this year, independent of pears, apples, plums, small fruits, and enormous quantities of melons and vegetables. All this has gone outside of the State and brought back large financial returns during a part of the year when our staple agricultural crops were months from their marketable condition. Lands that thirty years ago were returned for taxation at less than ten dollars per acre, now command from \$100 to \$150. Box factories, ice plants, fruit canneries and many co-related industries have been established in many sections and given employment to a number of people who found remunerative work difficult to secure before. It is my absolute belief that were it not for the conscientious work of your leading members, the present revenue of the State as derived from the increased land values would not be what it is now.

This question was fully considered at the annual session of 1907 at Augusta and the matter left open for final consideration until this annual session. Action must therefore be taken at this time.

#### NECROLOGY.

Colonel John M. Stubbs, for many years Vice-president of the Eleventh Congressional District, departed this life on September 16th, 1907. He was the first man to appreciate the need of an association of horticulturists who, by their united efforts, could aid in building up the many latent possibilities of our State, establish a School of Horticulture where our farmers' boys could be educated in the higher branches of scientific agriculture, and help lessen the then existing depression in our rural pursuits. On August 16th, 17th and 18th, 1876, a meeting of public-spirited citizens was held at Macon, and a permanent organization perfected. Our older members well know his devotion to rural progress and the great interest he manifested in the success of this Society. We will miss him in our work and friendly intercourse. We owe it to his memory that his life's work be suitably recognized by appropriating a page in our forthcoming proceedings and the resolutions which will be offered by one of our associates and co-workers.

Mr. M. B. Jones, of Thomasville, vice-president for the Second Congressional District, to which office he was elected at our last session, died January 24th, 1908. He was a man of great activity, successful in his pursuit, a specialist in melon culture, a staunch friend of our Society, and a most genial companion.

#### BENEFITS OF HORTICULTURE.

We are always attracted by the beautiful things in nature; our characters are wonderfully influenced by the cultivation of fruits and flowers which take the form of an affection for these loving friends in proportion to the care we bestow upon them. It has been said by masters in the medical art that the pursuit of horticulture is salutary to health and cheerfulness to those who follow it as a relaxation from intense business occupation or study, and this theory is sustained by the happy countenances of those who have followed this advice.

What more elevated character can there be found than a well-informed and sensible country denizen, who has taken up the life of a scientific and practical producer of the soil's best fruits, one who has by the application of sound scientific teachings been successful in his pursuit? To him this world has held out pleasures and contentment which seldom are the privilege of him whose life has been spent on the sea of mercantile speculation and turmoil. But let it be understood that in our rural education we must know the difference between the art and science of horticulture. Art teaches the manner, but science the reason of cultivation.

When the latter is well understood, horticultural pursuits are simple; but if we are deficient in the plain and practical arts of manipula-

tion, it is because we do not study the reasons for cultivation, and thus frequently misapply a good idea.

We are honored by the attendance of many of our scientific friends, who, animated with their interest in the world's progress, have come to us, in aiding us from their varied knowledge, what this association has taken for its ethics and mission to encourage.

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The PRESIDENT: Inasmuch as I have no complete list of the members present, I will defer the appointment of committees until later in the day.

Some of those who were to read papers have not yet arrived, and therefore it is necessary that we change our program to a slight extent. If Col. Cobb has his paper ready, I will be glad if he will let us have it now.

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## **Preserving and Canning Fruits and Their Commercial Sale**

BY COL. JNO. A. COBB, Americus, Ga.

*Mr. President and Members of the Georgia State Horticultural Society:*

There were two canning factories at and near Americus this season and each did a profitable business; one with a capacity of 35,000 to 40,000 three-pound cans per day of peaches. This latter plant was large and complete in every detail, cost between \$4,500 and \$5,000; 30-H. P. boiler and 15-H. P. engine.

The peaches were brought in in half-bushel baskets, distributed among negro women, who, with knives, split them open and extracted the seed. The halved peaches were then placed on a wire screen endless belt which ran through a boiler-shaped cylinder, and, as the peaches passed through, a stream of some patented compound was thrown on them, which took all of the fuzz off of the peach; and then through another stream containing disinfectant, and the peaches were poured out at the other end of the boiler free from all fuzz and worms, rot or other impurities. The peaches were then thrown on tables and women assorted them, placed them in three-pound cans, set them on an endless belt which ran down through a vat of water, which filled them with water; then they were carried to a place where women placed the top on each can; then they were passed through a machine with gas jet and solder attached, which soldered on the tops;

then to a man who dropped solder in a small hole which had been left in the top of each; then on, and just before the endless belt was reversed, employees lifted them off of the belt and placed them in a large open-work iron basket that held several hundred, then the basket was lifted by a crane and dropped into a large vat of hot water, remaining there a few minutes; was then lifted by the crane and turned and dropped into a vat of cold water; in a few minutes the basket was lifted and the crane turned and the basket deposited on the floor and the cans were then taken out, passed to a machine that put the labels on each; they were then packed in wooden cases containing two dozen cans each. They were then ready for the market.

This plant put up five grades of canned peaches. The first and second grades had about a tablespoonful of sugar put in each can. The lowest grades did not have the fuzz taken off of the peaches and are what are sold as "Pie Peaches." The plant was operated fifty days and put up over a half-million cans, all of which have been sold and shipped to various points.

They paid an average of fifty cents per bushel for peaches delivered at the factory and had a full supply all the time they were in operation. The water was supplied from the city waterworks. There were seven or eight white men familiar with the work. Most of the other labor about 150, were negro girls and women. They worked by the piece and made from 75 cents to \$1.00 per day. All the labor needed was available and did not interfere with farm work in the neighborhood, as those employed were a set of town negroes that generally live in idleness.

The other factory is located on the "Ware Peach Orchard," just south of Americus on the line of the Southwestern Division of the Central Railway.

The capacity is about 3,500 three-pound cans per day. They had a 15-H. P. engine and boiler; 1 water tank; 3 large boilers; 1 iron basket; 1 wooden cooler; 1 wooden crane with iron fixtures; gasoline tank and soldering heater.

The peaches were peeled by hand machine. All machinery under one cover, except the gasoline tank, which was thirty feet from the building. The cost of this outfit, not including water tank, engine and boiler, was about \$150. Deducting the cost of canning, the peaches netted them 50 cents per bushel. The labor employed was what they had on the peach farm.

To equip a factory, capacity of 1,200 to 1,500 cans per day, will cost, exclusive of engine and boiler, \$100. Capacity, 4,000 cans, \$200, and so on, in proportion, up to \$5,000.

The engine and boiler on a farm usually will furnish all steam and power needed, and therefore is not included in the cost of a canning plant.

The canning of vegetables requires more cooking than for peaches, but the additional cost of a vat, with coiled pipe for heating the water, will not add materially to the cost of the plant.

To give an idea of the importance to a farming community of the starting of a canning factory, I quote from a letter from Mr. O. M. Boyer, of Fincastle, Va., who manufactures canning outfits. He says:

"To give you a fair idea of how it is carried on, it started in this way: About thirty-five years ago a man by the name of John C. Moomaw had several thousand peach trees which bore well, and there being no market here and not knowing how to sell them on the markets in Northern cities, he decided to try and can them, which he did, with fairly good profit. This went on for quite a number of years and other people were standing off looking until they saw he was making more money than his neighbors. They started several other canning factories and then began to can tomatoes."

"The tomato business was quite profitable, as a farmer would set out about fifteen acres of tomatoes and engage them to the nearest canner at 20 cents, and sometimes as much as 30 cents, per bushel. This would bring them anywhere from \$500 to \$1,000 per crop raised on thin land. It went on this way for quite a number of years, until now we have over two hundred canneries in our county."

"We have a number of people who started out in a very limited way, and now they own good factories, good farms with good houses, and I do not know of a farm in the county that has a mortgage on it."

"This county supports four excellent banks. It has two tremendous can factories for making cans and I understand they are organizing a third can factory. They first bought a great deal of the machinery from the North, which they had me to alter and I began making it myself."

One of the inheritances of slavery, even among those who were not owners of slaves, that we find hard to get over, is false pride and a contempt for small things.

Slavery gave us an easy time, a negro at every turn to do our bidding. It is no wonder that it takes a long time to recover from the effects.

As Mr. Boyer says, it was a new man in a neighborhood who started the canning industry and it took several years of observation on the part of his neighbors, "before they went and did likewise;" but behold the results.

Necessity brings us to doing many things that in the end result in great benefit to us. The large amount of rotting fruit in our orchards is forcing us into the canning industry, and I am satisfied that it will open the door to our farmers for a great diversity of crops, which is the crying need of every section of our State. A farmer twenty miles

from a railroad will be able to can his fruit and vegetables, and when canned they can be marketed at any future time. This is one class of futures it is not dangerous to deal in. Canned fruits and vegetables sustain no loss or deterioration, and are as marketable in six months as they are the day they are canned, and there is always a cash demand for them.

This gives an idea of the cost of starting various size canneries and the probable profits.

The results, as shown near Fincastle, Virginia, should encourage our farmers to try the canning business. If only a few will make the experiment, I am satisfied that in a few years it will develop into a large industry and add very largely to the material growth and prosperity of our State.

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The PRESIDENT: Col. Brackett, your paper should have been first, but due to the printer's error it does not appear on the printed program; and as the programs were received only a few moments ago, there has not been time to correct the oversight. If you will honor us with your paper now, we will be glad to hear from you.

My friends, this Society is to-day honored by the presence of the greatest pomologist in the world. I take much pleasure in introducing to you my friend and colleague, Col. G. B. Brackett.

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## The Peach Industry in Georgia

BY COL. G. B. BRACKETT, Pomologist, U. S. Department of Agriculture,  
Washington, D. C.

*Mr. President, Ladies and Gentlemen:*

The pleasure of meeting with you on this occasion is beyond my power of expression. When my great and good friend, President Berckmans, invited me to address your Horticultural Society upon this, its thirty-second anniversary, I accepted with alacrity.

I have long known of your splendid organization and of its wonderful success and of the vast amount of valuable information it has been disseminating throughout the State. Your success is largely due to your selection of the right man for your President, and for continuing him in office from year to year.

For more than fifty years your good President has freely given his time and talent to the cause of the fruit industry in the South. Orchards on every side from the Atlantic to the Gulf, bear living testimony of his knowledge, zeal, foresight and untiring efforts. He has done more for American horticulture than almost any other man I know. The fact that he has been President of this Society thirty-two years testifies both to his integrity and to your appreciation of his sterling worth. No other horticultural society has been fortunate enough to keep one man in the presidency for that length of time. It is the custom of State horticultural societies to change officers every year or two, so that all the workers may have at some time or other worn the official insignia of President. You did not make this mistake. Each year has added to the experience and efficiency of your President. The work of President Berckmans has rarely ever been equalled and never excelled. He was preaching pomology to the South by principle and practice years ago, when I was doing the same for the territories of the Northwest. For more than fifty years the name of Berckmans has been a household word to the fruit-growers of the South and he has been backing his statements by good, honest, hard work until the Georgia peach, like the Georgia watermelon, has made your State famous in horticultural history. Georgia stands near about head of the list in number of peach-trees grown and in amount of peaches shipped. Your State could glut the markets of the Eastern States with its enormous peach crop, and this is just what would happen did not your shippers so thoroughly understand the business of marketing as well as peach growing. The industry in your State is divided into two sections: Peach culture and peach marketing. I will say a few words on each subject, not for the grower and shipper, who has had experience here for so many years, but for the young men who are yet to plant orchards and carry forward this industry in future.

#### PEACH CULTURE.

The apple constitutes about 55 per cent. of deciduous fruit trees grown in the United States and the peach is second on the list, as 28 per cent. Peach trees are grown in almost every State and it is possible to extend the industry several hundred miles further north than at present.

There are thousands of varieties of the peach, but there is but one species, *Prunus persica*.

The probability is that the peach originated in China, but came by way of Persia, for its christening.

This fruit adapts itself well to environment, but changes type with geographical lines. Its types have, therefore, come to be known as

(1) Persian, (2) Chinese Cling, (3) Spanish, (4) South Chinese, and (5) Peen-to.

The Chinese Cling group is the hardiest and succeeds best in the northern United States, while the Peen-to is adapted to the present southernmost area of successful peach culture. Between these two types lie the geographical lines of latitude where the remaining two, the South Chinese and the Spanish, are successful.

The parent of the Peen-to type was first grown in the South by President Berckmans at his home in Augusta, Ga., in 1869 from seed obtained from Australia. According to Prof. H. H. Hume, some twenty-three varieties of this flat fruited peach have originated in Florida, but only a small number of them are in commercial cultivation. The season of ripening of the Peen-to is from April to July, according to the variety and location. The tree of this type possesses willowy branches and long, narrow leaves; it is an upright grower and a prolific bearer. The Angel and Waldo are typical commercial varieties of the Peen-to type.

The South Chinese, or Honey, group was also disseminated from stock grown by President Berckmans. The type originated from seed obtained from China by the late Charles Downing and President Berckmans was busily engaged in distributing this stock as early as 1858, or within two years after establishing his Georgia nursery.

The peach should be emblazoned on the Berckmans heraldry, for President Berckmans may be justly styled the father of peach culture in the South.

The Honey type is well adapted to the Gulf States and the fruit follows the Peen-to in season of ripening.

The Spanish, or Indian, type was probably introduced into Mexico from Spain about 275 years ago. Nuttall, the botanist, stated that he found the peach growing in its wild state as far west as the present State of Arkansas about 1812. The Spanish type is adapted to the whole South.

The type characteristics are reddish young wood of tree; the large, long, spreading limbs; large blossoms and small flat foliage; the fruit hangs on the tree until late fall and stays green through a severe drouth; the fruit in color is usually yellow, streaked with blood-red beneath the skin. The tree is a sure bearer, and a heavy cropper in its native zone. The Texas, Victoria, Cabler and Columbia are representative commercial varieties of this type.

The Chinese Cling type probably reached America about 1850, having come to England some six years prior to that date. This is the great commercial type. Originally the fruit was mostly cling or semi-cling. The foliage is large, luxuriant and flat and turns a peculiar pea-green in the autumn. By this characteristic it is readily dis-

tinguished from other types. Its representatives are General Lee, Thurber, Greensboro, Carman, Elberta, etc. The Elberta is successfully growing over a larger area of country than any other variety of peach, and perhaps has netted the growers more money than any other, it being to the peach family what the Ben Davis is to the apple group.

The improvement of the Chinese Cling type in Georgia is largely due to the energies and foresight of Messrs. Berckmans, Miller, Rumph, Husted, Stubbs and other members of the Georgia Horticultural Society. Three of the most prominent varieties of the Chinese Cling type, Elberta, Belle and Thurber, originated in Georgia and on Georgia hills are veritable gold mines.

The story of the Elberta reads like a romance and is interwoven in the history, commerce and literature of the State.

In 1872, Samuel H. Rumph, Marshallville, Ga., fired by the zeal of horticultural enthusiasm, believed there were better peaches to come from this strain than had yet been grown; he accordingly planted out 1,200 seedlings and patiently segregated them until there remained but one fruiting tree, and this to him represented the ideal for which he searched. He named the new candidate 'Elberta,' in honor of his wife. He exhibited the first fruit of the original tree to this Society. He had faith in this peach and planted large orchards of it. He realized profitable returns, but that was of little consequence to him compared to the great gift he bestowed upon American horticulture. Commercial peach-growers in the north temperate zone will be indebted to him for many years to come, for the Elberta has been an undeniably great factor in successful commercial peach culture. The white fleshed varieties are more in demand in some of the markets of the North and East, but Elberta, easy to grow and easy to ship, always appears in the distant market in the pink of perfect condition.

To President Berckmans we are indebted for the origination and dissemination of other almost equally famous varieties of this group. He has done a great work for the South in disseminating choice varieties and in instilling into the minds of the people the best methods of maintaining commercial orchards. Georgia peaches are well known in every city of size from the Rocky Mountains to the Atlantic Coast, from Canada to the Gulf.

The Georgia peach was greatly in evidence in the markets of the national capitol several weeks ago, and merely through curiosity I asked a leading grocer:

"What are you paying for peaches?"

"We would not handle any local peaches," he replied. "We would not give anything for them, not when we can get fine Georgia peaches that we can sell for two or three cents a piece." So the Georgia peach has captured the national capitol.

The lands of Georgia are well adapted to peach culture, as has been proven by your extensive and heavy-bearing, well-kept orchards. The warm, sandy soils, rich in humus, and with a light clay subsoil, are considered safest.

Successful peach growing largely depends upon the man behind the enterprise.

First: Thorough cultivation of the orchard is an absolute essential.

Second: The tree must be pruned annually by shortening in one-half of last year's growth.

Third: The ideal peach tree is low in head and somewhat spreading in habit. With a tree in this form, the most of the fruit can be gathered without the use of a ladder.

Fourth: The average peach tree is apt to set several times more fruit than can be fully developed. Therefore, in order to obtain fruit of good size and appearance, thinning of the crop is absolutely essential. With such treatment the crop will bring better returns than otherwise.

The disastrous freeze of 1906 that ruined so many hundreds of peach orchards in Michigan taught the growers there several useful lessons. Trees with short trunks and spreading heads were not so severely injured as the taller growing trees. The white-fleshed sorts of the North China type are the most hardy in bud.

In the South, nearly every winter, there are spells of warm weather that start the buds into growth to a greater or less extent. Fruit buds that have made a vigorous growth after relatively severe pruning are less liable to frost injury. A healthy growing, well-trained, open-headed tree should come through the winter with much less injury to fruit buds.

On warm days in winter, varieties that finish their resting periods early are easily pushed into slight growth. Varieties of the Chinese Cling and green-twiggged types that finish their resting periods late or whose buds remain dormant a greater length of time are better able to withstand the caprices of the weather. The purple-twiggged varieties are more susceptible to winter injuries than the green-twiggged varieties and from the latter we may later find frost-resistant sorts that will defy old Boreas and thus the vagaries of climate will be overcome by the peach-grower. The fruit on an open-headed tree is not likely to rot so badly because sunlight is the best fungicide.

*Monilia fructigena*, brown rot of the peach, has done a good deal of damage, especially to the early ripening varieties. Its ravages are

widespread and the loss is very great in warm, moist seasons. Your State Board of Entomology has rendered you vallant assistance along the pathological and entomological side of peach growing. The peach orchard of the average farmer does not receive the proper attention it deserves, but State pathologists, by use of Bordeaux mixture and other fungicides, are more readily keeping this peach disease under control.

Every peach orchard is improved by careful spraying. Spraying should be done at least three times each season—first, before the foliage starts in the spring; second, when the fruit has attained the size of a hazel-nut; and third, just before the fruit matures. This last spraying seems not only to keep the fruit tree in healthy condition, but it rids it of some of its surplus foliage and enables the sunlight to get better play, and thus the fruit attains a better color thereby.

If the brown rot is apparent in quantity just before the fruit ripens the trees should be sprayed with an ammoniacal solution of copper carbonate.

There is necessity in these competitive times of meeting ever-changing conditions of trade with methods of adaptability and enterprise that falls little short of genius.

To put color on fruit is of prime importance to the peach-grower. Color is not always synonymous of quality, but it is one of the most important factors of success in marketing the crop. The peach-grower can control size, color and quality of fruit to a large extent by proper culture and fertilization and pruning. Every tree needs food and drink as well as an abundance of sunlight. Phosphoric acid, nitrogen and potash is the trinity to which many a grower pins his faith for adding color to his fruit, but an open-topped tree is of vastly more importance as the sun paints the beautiful tints of red, as no other artist can do.

It may interest you to know that the area of successful peach culture will soon be extended several hundred miles north of its present boundary. This will be made possible through the segregation and propagation of the hardest varieties of the Chinese Cling type. Hitherto, Bailey and Bokhara No. 2 peaches, noted for hardiness, rather than quality, have stood for this hardy type, but recently there has been found in Iowa light-fleshed peaches, late in season, hardy in tree, and good in quality. Most of these are seedlings and some have been named and have stood the test of propagation for some years and have brought \$4 per bushel in the markets of the Northwest, and the trees have borne remarkably heavy crops. It is reported that these trees have withstood freezes that nipped the branches of the oak trees; so we have no doubt of their hardiness. One variety received at the Department of Agriculture early in November was still intact on December 1st, and, though the heat of the offices had caused the fruit to wilt

somewhat, there was not the least sign of decay about it. Of these varieties, Leigh and the six Bednar seedlings seem to be the most valuable.

There are peaches grown in northern Iowa and southern Minnesota and the time is not far distant when peaches will be grown in the Dakotas.

The commercial side of this subject is of paramount importance. Marketing the crop has been said by some to be "The happiest part of the whole job." To market successfully a large peach crop requires as great business acumen as is displayed by captains of industry in any other branch of trade. The successful peach grower studies carefully the reports of crop estimates for several months before his crop is ready to sell.

Your Georgia peach industry is therefore divided into two branches, the scientific and the commercial. These two branches work harmoniously with each other. President Berckmans and this Horticultural Society have told you for more than thirty years how to grow peaches; and the Georgia Peach Growers' Association has essayed to handle the commercial side of the problem. There are many slips in the marketing of a State's peach crop, and the association is trying to eliminate these mistakes. The magnitude of the peach industry in Georgia caused you some alarm in the early season when it became evident that you were to handle the largest crop in the history of the State and that several weeks earlier in ripening than ever before, and that a crate famine was imminent.

Packing is one of the most important features of success in peach marketing. No package has ever been devised that seems better adapted to peach marketing than the Georgia crate that holds three pecks of peaches, packed in six small open baskets of one-half peck each. The Georgia carrier is welcomed throughout the markets of the United States. It is the standard crate of uniform size; it makes a neat package, acceptable to wholesale dealer and retail trade alike, as well as to the householders and to the transportation companies. None but best fruit should be packed. The finest fruit carefully packed and neatly labeled brings the highest prices in the market and more than repays the extra cost of the package.

The fruit must be without blemish, perfect in shape and uniform in size and color. It is better to employ your own picking gang and none but expert packers.

In California half of the peach product is sold to the canners at the uniform rate of 50 cents per bushel. This is a wise precaution, as it gets much surplus stock out of the way and enables the remainder to be sold at remunerative prices.

The by-product of a peach crop, such as surplus stock, small and over-ripe stock, should go to the canners, driers and other firms in position to handle such stock. In this way prices are maintained. If New York City had received about half as many peaches this season as Georgia shipped to it, and if the small cities and towns throughout the East and middle States had been well taken care of in the matter of systematic shipments, the Georgia peach-growers would have probably received double the amount they did receive for this year's crop.

Some Georgia peach-growers have claimed that this largest and finest peach crop, taken as a whole, was unremunerative. Remember the old adage: "Make your mistakes teach you something."

#### MARKETING.

The Georgia peach crop this year of over 7,000 carloads, exceeding \$5,000,000 in value, coming two weeks earlier than usual, caused you great uneasiness because you were confronted by the two impending crises of scarcity of labor and a crate famine. The Carmans were not fairly on the market before they were followed closely by the Hilleys, and those in turn by Belle's, Thurber's and Elbertas, until the whole peach situation was expressed in one word: "Rush," and grower and shipper were glad when it was over. At the outset, when canneries were over-run the early markets surprised and nearly glutted, prices threatened to run away down, all of which shows the necessity of taking time by the forelock and being well prepared for the shipping season. Cool weather, good business management and a well-sustained market helped out the situation exceedingly, and the fruit held up well because it was properly handled and packed and buyers were not afraid of taking the risk of holding the stock excess for a day or two.

Mr. Hale, of the Ft. Valley Orchard Company, who has been growing peaches in your State for more than sixteen years, states that the cost of production of 36 cents per crate is increasing annually. He counts the incidental expenses of harvesting, packing and putting the crate into the car, 35 cents more, making the total cost of a crate of peaches f. o. b. the cars in Georgia, 71 cents. Freight, refrigeration and cartage and commissions run this price up phenomenally, and gross proceeds of sales vary on different days and in different markets.

Mr. Hale figures that crates and baskets cost the Georgia peach-growers this season \$425,000; refrigerator cars, \$325,000; railroad transportation, \$1,000,000; commission men and wholesale dealers, \$200,000; retail merchants over \$1,500,000, thus benefiting seven different sets of people in seven different branches of trade industry, and he figures that the grower, who made all this colossal trade possible, received the least of all.

How to protect the interests of the great and small grower equally well in this industry is the problem that confronts you. This question was paramount at the annual meeting of your Georgia Peach Growers' Association in convention in Atlanta, May 13th.

There needs to be closest sympathy and co-operation among the growers in order to make the work of this association effective. Your watchword of success is "Organization." An organization managed by perfect system. Statistics should be furnished of the total number of crates to be shipped and some estimate made of probable net returns. No State nor set of growers can hope to control the market unless there is an even, systematic and proper distribution of the crop. To send five to ten carloads of peaches to New York when the market is already glutted is to court failure. To see New York overloaded 120 cars of peaches and not a peach in nearby small cities, is the result of indiscriminate shipping and distribution. Make a study of the population of the small cities; study their wants, their tastes and their needs. An even and systematic crop distribution can only be had through the sagacious management of a well-organized association. The plan of the California citrus growers' association is one of the most perfect yet devised. The supply in any market is kept just a little beneath the demand. A city's appetite is kept whetted for oranges and is never fully gratified. Results are surprising and are always satisfactory, and grower and consumer is in good humor and no glut has occurred on any market, and there has been no appreciable loss of fruit. The grower in this case controls the retail output. Success means fresh stock, in fine condition, evenly packed, uniformly labeled, and crated, carefully handled and judiciously marketed. It is stuff in all stages of ripeness, rottenness and decay that causes unnecessary gluts on the market. Wise shippers have had, in some cases, to go on the peach market this season and buy carloads of this stuff and get it out of the way before offering their own fresh, clean, attractive stock. Fruit, to reach remunerative consumption, must be fine in quality and reasonable in price. Only good fruit will return profit. Keep the common stock off the market.

Georgia peaches this season were uniformly the finest and best the State has ever grown, and grower and shipper alike is to be commended for the best work in the peach industry that was possible, under existing circumstances.

When the Georgia peach-growers realize the truth of that old saying: "In union there is strength," when they have organized as a unit with one common interest in view, and have placed at its head the very best financial talent to be found in the organization, as its managers—men of sagacity, keen foresight and integrity, working individually and

collectively for the good of the whole, either through its present Peach Growers' Association, or any other organization the growers may select and stand by—then, and not until then, will the growers of Georgia peaches receive their full share of the profits of the industry. Grade your fruit carefully, pack none but perfect fruit. Establish canneries and can the surplus stock, rather than throw it on the market, which would only lower the price of your best grade. Let each man of the organization work for the best good of all, and all in unison work for the establishment of the most perfect system of organization that can possibly be devised.

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The PRESIDENT: Since Mr. Madre is not present, I will ask Mr. Waernicke to read his paper.

ADDRESS BY MR. H. E. WAERNICKE, REPRESENTATIVE OF THE LAND AND INDUSTRIAL DEPARTMENT OF THE SOUTHERN RAILWAY COMPANY, WASHINGTON, D. C.

*Mr. Chairman, Ladies and Gentlemen:*

I am grateful for the privilege of attending the Convention of the Georgia State Horticultural Society, which I consider one of the most important development agencies at work in your domain. My credentials come from the Land & Industrial Department of the Southern Railway, of which I have been an active employee since its organization. My message to your body is an assurance that the department I represent is deeply interested in the work you are engaged upon, the further improvement and development of agriculture, horticulture and kindred pursuits.

In our department we are constantly preaching the doctrine of diversification of crops, which embraces an unceasing campaign in favor of the growing of fruits and vegetables, as well as the pursuit of other lines of industry which make for the success of the farmer and planter of the South.

I can not better illustrate the importance attached to this doctrine of diversification by the management of the Southern Railway than by reading a letter which was only a few days ago addressed to the press of the South by the able and wise president of our company, Mr. W. W. Finley. Mr. Finley says:

"My duties require me to keep in touch, as nearly as possible, with business conditions throughout the country, and especially in the South. Since the beginning of the business depression from which the country is now recovering, I have been greatly impressed with evidence which

has come to me that, which business all over the United States has been unfavorably affected, the effects of the depression have been felt most severely, as a general rule, in those communities the energies of which are devoted principally to the production of a single commodity, or of a few commodities, and that business has been relatively less affected in those communities in which production is more diversified. I have been impressed especially with the fact that the business depression has been relatively less severe in those Southern localities in which the attention has been given to the growing of fruits and vegetables. There has been a steady market for these products and, although prices have not in some instances been as high as in other seasons, I believe they have generally yielded profits to the growers."

"The press of the South has already accomplished much by advocating diversification of agriculture and manufacturing, and, looking back over the past twenty-five years, we can realize that much has been accomplished in this direction. I believe, however, that the time is especially opportune for continuing our efforts in this direction and for urging that each Southern community shall make the most of the opportunities which a revival of business will open up to it."

"Nature has favored the South with practically inexhaustible resources of great variety, and the industrious and resourceful Southern people have shown their ability to take up and carry to success new lines of industry. I believe, therefore, that you will agree with me as to the desirability of encouraging still greater diversification of industry in the direction of utilizing to the fullest extent the natural resources of our section."

"Without attempting to enumerate the lines in which progress in this direction is possible, I would suggest that, in many localities, agricultural prosperity might be advanced by further diversification of farming, especially in the direction of producing the fruits and vegetables best suited for each locality; that live stock and dairying might profitably be carried on more extensively than at present."

"Industrially, I believe it should be the aim of the South to add to the profits of producing raw materials, the profits of manufacturing by converting Southern raw materials, as far as possible, into articles ready for use. As indicating what may be done along this line, I may refer to the cotton textile industry. Although the South has a substantial monopoly in the production of the most widely used textile fibre in the world, some of us are old enough to remember when it was believed in many quarters that cotton manufacturing on a large scale could not be established successfully in the South. The Southern people first demonstrated their ability to make the coarser grade of cotton fabrics, and they are now demonstrating their ability to make the

finer grades as well, and to bleach and finish the products of their mills. I think we may look forward with confidence to the further development of this great industry and of industries depending upon it, such as the manufacture of cotton goods into articles of clothing ready for wear."

"I might enumerate a long list of opportunities for the further development of manufacturing. It would include the conversion, on a larger scale, of Southern made leather into boots and shoes, harness and belting in Southern factories, and the conversion of the products of Southern forests and mines into a long list of articles ready for use. I have said enough, however, to suggest to you that point I wish to make, which is that I believe that all of us who have the prosperity of the South at heart should do all in our power to encourage the diversification of Southern industry and the conversion in Southern factories of Southern products into articles ready for use rather than their shipment to other sections in the form of raw materials or of partly manufactured commodities. I need not assure you of my great interest in every movement for the advancement of a Southern community, and you know that this company, through its land and industrial department, stands ready at all times to co-operate in every proper way with individuals and communities along its lines for the establishment of new industries, the promotion of such immigration as may be desired by each community, and the general advancement of Southern prosperity."

The Land and Industrial Department of the Southern Railway, under the forceful and skillful direction of Mr. M. V. Richards, with whom many of you are doubtless acquainted, is doing a broad work in advertising the agricultural and industrial opportunities of the South. Its watchword is co-operation—co-operation with everybody, every individual or organization taking an active part in the upbuilding and developing of the great area of undeveloped territory penetrated by our line of road. We have built up connections and facilities for getting in touch with the outside business and financial world that are most valuable. They enable us to put before capitalists and home-seekers and investors, throughout the United States and in Europe, the varied resources of our territory in a way that commands the serious consideration of these people.

It is by a system of co-operation with the people along our line that we are enabled to put into the hands of the outside world reliable information concerning Southern opportunities. In this day of extraordinary business activity and strenuousness we are compelled, if we would have success, to loudly and intelligently proclaim to the world through the byways and the hedges what we have to offer. This is what the Land and Industrial Department of the Southern Railway is endeavoring to do for the territory that it serves.

The PRESIDENT: Col. Fort, are you prepared to give us your paper?

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## Cherry Growing in the Upper Districts

BY COL. JNO. P. FORT, Mt. Airy, Ga.

*Mr. Chairman, Ladies and Gentlemen:*

I see your committee has placed me upon the program for an address upon the growing of cherries in the upper districts of Georgia. I have not prepared a paper, and will confine myself to giving you some of my experiences in the matter of growing cherries.

As far as I know, I have the only commercial cherry orchard in the State, and possibly my experiences will interest you more than any theory I could give you. This experience has been gained from a cherry orchard located within half a mile from this building. Ten years ago I contemplated putting out a cherry orchard. It was an entirely new thing, and I had no data to guide me as to what cherry I should use or what I should do.

I consider there are three classes of cherries. The Morello, or sour, type is what you would call the old-fashioned pie cherry. Then there is the Duke cherry, and then there is the class of cherry called the Bigarreau cherry. When I proposed to put out an orchard, I put in two rows of the very best class of each one of these types of cherries. Time went on, as it always does, and my cherries commenced to bear, doing only reasonably well, but in the second year from planting of course I watched each type to see what it would do. There was one type of my cherries that surprised me very much. It was a tree called Smith's Bigarreau.

Cherry growing was thought to be impracticable and unprofitable in Georgia, because of sun blistering, due to the fact that the cherry sheds its leaves very early. When I wrote to Mr. Brackett, of the Division of Pomology of the United States, he discouraged me very greatly; he said the cherry only grew in places like Oregon, say, where it rained a great deal.

Well, in the second year, I noticed one of my Bigarreaus holding its leaves in a remarkable way; it held its leaves and protected not only its trunk, but also its body with a very large leaf, which prevented sun-scalding entirely. When it was two years old, I became satisfied of the truth that it did hold its leaves and protect its body from sun-scald. That was in 1900. I then obtained 200 of these Bigarreaus and planted them out, and have them now. These trees have grown with

the greatest success. It is hard for you to conceive of a tree more beautiful in appearance or more vigorous. It would make a fine shade tree. Those 200 trees are now coming into their seventh year. It is well worth the while of anyone interested in fruit growing, to see those trees. They are capable of bearing a great crop, but so far they have borne very small crops. You may ask me how I consider a tree so highly that bears but little fruit, and I will tell you. Some of our fruit trees are very late in bearing. One of our Pippin apples is nine years old before it will bear. This tree having shown such great vigor and body and strength, I anticipate great results from it. If this orchard should bear like it seems it is capable of doing, it will astonish you with the amount of the fruit it will bear, and the value of its product. They are not barren trees because they bear a very few cherries, but they seem to be growing. This Smith's Bigarreau is about the size of a blue-bird's egg; it is a delicious fruit.

Whereas, I can not recommend any one planting that tree, because it has not borne much fruit yet, I trust in two or three years to have a picture to show fruit growers that will be of great benefit, and I think that cherry will be planted all over this section of Georgia.

For the sweet cherries I have grown in my orchard, I have obtained high prices. I have sold them for 20 cents a pound. I have packed them in a flat box like the California cherries. They are superior in flavor to the California cherry, like our peaches are superior to California peaches. Atlanta is the market for them. Some of my cherries met with no success, because they shed their leaves too early and were injured by the September sun. I consider the Smith's Bigarreau will prove a benefit to this section.

There was a gentleman here some time ago from California who said he never saw an orchard equal to mine—never saw a tree that had such shade. This tree does not need pruning at all. Its limbs seem to be perfectly set. It makes a beautiful tree. It would make a beautiful shade tree for anyone's lot, and now is the very time to see them. It is a tree probably 30 feet tall. Its branches are probably 20 feet in diameter, and I hope for great results from this cherry.

There is a great demand for cherries, because there are so few on the market. While they are troublesome to pick, you can see how great the profit is at \$2.00 for an ordinary half-gallon basket. That is what I have sold mine for in Atlanta.

All cherry trees are inclined, if you bruise their roots and cultivate them too deeply, to spring up what is called scions, and I warn you against plowing cherry trees too early in the spring and thereby bruising the roots.

These cherries ripen from about the 10th to the 20th of May. To show my faith in the cherry, I have an orchard about 40 miles from here in the heart of the Blue Ridge; it has been two years since I organized that orchard. It had about 70 apple trees on it, and I have had a great crop from those trees and am shipping apples from those trees now. But, to come back to the cherry. I planted 100 of those cherry trees there in a climate that is much more moist than this, and it is more adapted for cherries; it is among the clouds. They have grown with the greatest vigor; so far as growth is concerned, no one could ask more. Although it has not borne profitably, I have shown my faith in it by planting 200 of the trees. The cherry has a very open bloom, and unless the seasons are right the pollen will shed out of the bloom and it will bear but a sparse crop. It is a wonderful fruit when we want, say, the acid of the cherry; it is a great favorite; it is the favorite of all pie fruits. In my early recollection, there were some few cherries here and there. I recollect Mr. Ben Jordan was a man who raised cherries, and he was asked how to make cherry-pie. He said "Sweeten it to suit you, and then turn over the sugar-dish into it."

The cherry has nearly disappeared from middle Georgia. Those 200 trees that I planted came out of the ground smoothly and nicely, and have borne probably a pint of cherries to the tree. If that orchard does what it seems capable of doing, it ought to be a very profitable one.

I thought it better to give you my experience rather than make a speech upon the subject of the cherry. If any of you gentlemen desire to ask me any questions, I will be pleased to answer them if I can.

Mr. ELLIS: What stock are your cherries planted on?

Col. FORT: It ought to be on cherry stock. I obtained this cherry from Geneva, N. Y.

Mr. McHATTON: What method of cultivation do you follow? I noticed you said you did not approve of cultivation early in the spring.

Col. FORT: In the first place, I planted my cherry orchard with a great deal of care. I used a good deal of ground bone in planting them. If you plow the cherry tree very deep and bruise the roots, they will throw up a great many sprouts. You can cultivate them in the fall of the year without injury.

Mr. WORSHAM: I would like to ask you about the number of blooms that occur on these trees.

Col. FORT: It has but few blooms, but it seems to be preparing itself for a great many blooms. I am not prepared to recommend this cherry, except to say that, if you will plant one, it will produce a fine shade tree if nothing else. When I found that cherry holding its leaves and protecting itself until frost, I thought I had discovered something wonderful.

The PRESIDENT: Have you reference to those beautiful trees below your orchard?

Col. FORT: There are one or two trees there, but my main trees are up on the hill. If you want to see something beautiful, go to the orchard up on the hill, about 100 yards from here, and there you will see the 200 trees I planted.

The PRESIDENT: Why don't you graft them with a productive variety?

Col. FORT: No, I don't want to spoil that tree. It will do you fruit growers good to see those trees; they are a picture within themselves. It is a graceful tree, and I have confidence that Nature, which made such a beautiful cherry tree, will also eventually make it bear an abundance of fruit.

Col. WADE: I wish to announce that it is thought best, in order to let our people have an opportunity of showing you around here, to have a short session this afternoon, and about 5:30 we will take as many to ride as possible, and do away with the night session.

I wish all citizens in the town would have all their carriages here at 5:30 and take our visitors out to ride and show them what we have.

The SECRETARY: I am requested by the President to announce the appointment of the following committees:

Committee on Examination of Fruits—Col. G. B. Brackett, Washington, D. C.; Prof. T. H. McHatton, Experiment, Ga.; Guy L. Stewart Dent. of Agriculture.

Committee on Resolutions—Prof. Jno. N. Rogers, Sparta, Ga.; Judge H. L. Long, Leesburg, Ga.; Prof. F. S. Earle, Cuba.

Auditing Treasurer's account—Dr. Neil McInnes,\* Augusta; Col. Jno. P. Fort, Mt. Airy; Geo. W. White, Sparta.

The PRESIDENT: When our program was made out, we hoped that all those who had promised essays would be present, but they are not, and there is no likelihood that they will be here. Therefore, we will have to reconsider the matter of a night session. I think it would be best to dispense with the night session, and let the other matters come in during the afternoon session.

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## AFTERNOON SESSION

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### Good Roads A Necessity in Fruit Transportation

By T. R. LOMBARD, Cornelia, Ga.

*Mr. President and Gentlemen of the Horticultural Society:*

I approach the subject assigned to me with some diffidence because I feel that my information on the subject is not sufficiently extensive to give my views authority. I therefore beg to submit extracts from a paper read at a convention of the Oregon State Good Roads Association, held at Portland, October 24th, 1903, by Mr. A. L. Craig, General Passenger Agent of the Oregon Railroad & Navigation Co. Mr. Craig says:—

"I am glad to have the opportunity to say a few words on so important a subject as the railroads and wagon roads, although I think, had I been selecting the subject, I would have placed the wagon roads first and the railroad last, that being the natural order, both to priority and importance."

"Centuries before the railroad was ever dreamed of, wagon roads existed and their improvement had the earnest thought of the progressive element of the community through which their course lay."

"Without the wagon roads, the railroads could not exist any more than cities and towns could prosper without a surrounding country to support them. Railroads are frequently referred to as trunk lines, and this simile is an apt one. If the railroads are the trunk, then the

wagon roads stretching out into the adjacent country are the roots which bring to the trunk the business which supports it."

"To assert that better wagon roads are not desirable or necessary would discredit the wisdom of the brightest minds in the railroad work. Railroad managers spend millions upon millions of dollars to do for the properties they represent exactly what the gentlemen interested in the good roads question are endeavoring to have done for our wagon roads. All this expenditure means what? Simply that a given amount of power shall be able to haul more tons than heretofore and that in the transportation of the railroad business its motive power and rolling stock shall not be subjected to the strain and shocks that had to be borne when the road was less nearly perfect."

"Have you, who live from ten to twenty miles from a railroad, ever considered that, in addition to a great reduction in the wear and tear on horses and wagons, as well as upon yourselves, good roads increase the value of the land itself by, as it were, picking it up bodily and placing it nearer the town?"

In the contention of the gentleman that good roads are quite as important as railroads for the improvement and betterment of the country, I am inclined to concede the point as well taken, and believe that good roads are of paramount importance to the orchardist, the farmer and to those of the towns and cities who depend upon the agricultural industry for their business.

Values of farming properties are always increased by the improvement of the highways over which the farmers send their products to market. A good road means a minimum of wear and tear on stock and wagons, a maximum of tonnage to be hauled and a saving of time to both stock and driver.

Many states have expended vast sums in the improvement of their roads to the great advantage of the people and an immense increase of values.

To go into a statistical description of what has been done by some of these would be too long and tedious to be attempted in this paper. The celebrated Catharpin turnpike, in Virginia, built before the war of the Revolution, under the superintendence of George Washington, stands to-day as a monument to the enterprise and intelligence of those days, and shows that even then the importance of properly constructed highways was fully realized.

It is difficult to point out the importance of what a good road means to the fruit grower without showing that it is equally important to the agriculturalist and the merchant. The wise man looks carefully to all the details of his business and endeavors to protect himself against loss at every point. The fruit grower is as dependent upon good roads

over which he sends his fruit to the cars for the safe arrival of his produce in prime condition, as upon any other one factor. Of what use is careful cultivation and fertilization of orchards, and expert picking and packing of fruit, if the few miles of road over which the crates are hauled to the railroad are so rough that the jolting has bruised the delicate fruit, making it unfit for use, returning only loss and disappointment to its owner? Good, well-constructed roads, free from ruts and gullies and of sufficient width to permit passing of vehicles on the level, will do as much as any other one thing to benefit the fruit grower, the farmer and the community generally.

Society, as a whole, is made to be inter-dependent and the success of the chief agricultural industry of a section means the success of the whole community. It is the basis of their wealth and advancement. Good roads mean the extension of the territory available for fruit raising, for, recognizing the importance of short hauls over the imperfect roads of the country, the orchardist seeks lands nearest the railway station on which to establish his orchard, so that to-day land that is within a mile or two of the stations easily commands from two to three times the price of similar lands outside of this radius. Good, level, well-constructed roads would result in the extension of this radius from three to five miles with the result of increase of values and population.

Georgia is far behind many of her sister states in building good roads. Some counties have successfully introduced the alternative road law in place of the crude and unsatisfactory law under which this county operates. I have no data regarding the roads of Georgia later than 1904, but statistics show that at that time there were 57,203 miles of public roads in this State. Of this, 639 miles were surfaced with gravel, 438 miles with stone, 513 with sand and clay mixtures and 24 miles with shells, a total of 1,634 miles improved or only 2.8% of the whole. With one mile of road to every 38 inhabitants, we have only one mile of improved road to every 1356 inhabitants.

Habersham County has 300 miles of road, and if the time of each man subject to working the same in this county each year were computed at 75 cents a day and he worked seven days in the year, it would make a total amount of \$4,725 each year. In addition to this, there is about \$300.00 cash expenditure by the county, or \$1.00 a mile.

It would take a paper by itself to treat of the subject of the importance of the alternative road law to a county, as against the system now in use. It should be obvious to every thinking man that upon the establishment of good roads in his county depends the success of the people to a greater extent than any other public utility. The people of the towns should contribute as largely to the making and maintenance of these roads as the farmers, because the success of the town is

absolutely dependent upon the agricultural industry surrounding it, and that town most easily approached by the widest territory, will have the greatest success.

The PRESIDENT: How many miles of roads are there worked properly with gravel and rock bottom?

Mr. LOMBARD: It is a thousand and some hundreds of miles.

The PRESIDENT: In Richmond County we have over 400 miles of roads, and more than 300 miles are worked with gravel and other material. Therefore, I think those figures can not be correct.

Mr. LOMBARD: In 1904.

The PRESIDENT: At our last session Prof. Rogers gave us such an elaborate address upon the condition of our district agricultural schools, that I have received many requests that he give us another one similar to it.

I now take pleasure in introducing to you Prof. John N. Rogers.

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## Our District Schools—The Needs They Should Fill

BY PROF. JNO. N. ROGERS.

*Supt., Tenth Congressional District Agricultural School.*

I am not before you with a prepared paper, but I am here in a cause which should be dearer to every Georgian than anything except his religion, and superlatively so should this subject be to the heart of any man engaged in any way in the cultivation of the soil or raising crops of any kind. I was very much struck with some of the points in the paper just read on good roads. If our people could realize what good roads mean in Georgia, the value of the rural property of the State would be doubled in less than five years through this medium alone. Where a man now goes with a team of two, and in some instances, four, mules, to carry 1,000 pounds six, eight or ten miles in the country, with a proper road and one pair of mules, he could carry two or three or four tons that far in the country. There are places in Georgia where such a change has come about. A few counties like Floyd, Rich-

mond and Bibb have worked wonders. The example I shall refer to, I take from Floyd County, because the roads there are more like this section; the land there and the material out of which to build roads are more like this. A farmer told me, "I live twelve miles from Rome. I formerly brought two bales of cotton to town with two mules, and it was an all-day trip. Now, I bring six bales of cotton to town with two mules, and I can get back to dinner if I wish." Suppose that man had twelve bales of cotton to bring to town! With four mules and two bales a day, it was a week's work. Under the system of roads they have there now it is one day's work for four mules. Thus, instead of being twelve miles from town, he is, as compared with the old roads, only two miles from town. His property had increased in value just like he had picked it up bodily and moved it only one-sixth as far from town as it was before the new road was built. He was six times nearer the market than before the road was worked, so far as putting his produce on the market was concerned. That would apply with equal force to three-fourths of the roads in Georgia. It is a shame on our civilization that we have let this question rest as we have.

Who can build a road in Georgia? I say it with shame that there are not one hundred men who can be hired for such work in the State to-day who know how to build a road. Then it falls upon some school or schools to set about to study this important question, and that will be one of the tasks of these agricultural schools to take into consideration, and give such instruction to their students that each one, when he goes back home, will take the lead in the building of good roads, and this should, within less than ten years, pay for all these schools will cost in the next generation.

In the development of every new enterprise or avocation of man, as it settles down to a scientific basis, the more objectionable or less profitable features of the business are crowded aside, and by controlling the waste of a business the profits are increased. In days gone by, every man was his own butcher, and slaughtered his own animals. We had no packing houses, and there was little attention paid to the hair and hoofs and horns of the animals. Did not the great packing houses of the country utilize the blood, and hair, and hoofs and horns of the animals they kill, some of them which now make large dividends on the money invested would soon fail to declare any dividend at all, and some of them would soon go out of business. The agricultural industry and the fruit industry, in Georgia and Alabama, and other sections is fast approaching the stage where, if the waste product is not taken care of, they will have to quit business. Those who take care of such things will be enabled to make so much money that the man who does not take care of the by-products or waste will be forced to go to the wall. During this present year it is safe to say that every man

who has shipped a carload of peaches has thrown away, or given away, or used to almost no purpose, at least fifty bushels of peaches. If that fifty bushels of peaches had been utilized as it could have been with some preparation and some instruction, it would have amounted to more than the net profits on the crop as it stood. In every bushel of peaches, with \$1.50 worth of sugar, there are 10 gallons of as fine syrup as was ever produced in Georgia; it will command a higher price than the Georgia ribbon-cane or any other syrup on the market. Allowing 50 cents a bushel for these over-ripe peaches, or culls, they would have produced a syrup that could have been sold in the market at from 50 to 60 cents a gallon.

The better class of fruit, that was fit for canning, has in some communities been canned, and it represents larger profits than many carloads that were shipped out of the State. If the French farmer had the peach seeds out of the Georgia crop, he would make more money out of them than the Georgia farmer has made out of the whole peach. It took him a long time to learn these things, and he had to be taught a severe lesson before he commenced to learn them.

In 1818, when the German empire lay prostrate at the feet of France, begging for peace at such terms as they might name, asking to be let alone, they began to realize that the trouble in Germany was in the rural districts; they saw that until the peasantry should be instructed in methods that were helpful to them, there was no hope for the rehabilitation of the nation; and not being under a democratic government as we are, they at once put schools in operation and taught their boys and girls how to cultivate the gardens, how to till the soil, and why the soil should be tilled. Fifty years later those two nations came together, and the result was just as decisive in the other direction. France went down before Germany, and she profited by her failure just as Germany had. If the peasantry of France had been sold out, lock, stock and barrel, at the close of that war with Germany, they wouldn't have paid more than two years' interest on the debts they owed, to say nothing of the principal.

In less than 28 years, let us see what those French farmers have done since they put their boys and girls at schools. The French farmer to-day, on the average, invests more of his net profits than the Georgia farmer makes from all his labors. The Georgia cotton crop of 1906-07 would not bring as much money as the product from the same area would bring the French farmer. The acres of cotton planted in Georgia, —the gross proceeds brought from that land would not bring him as much money as the French farmer's land would on the same acreage. The French farmers have already bought all the land that is for sale in France; they have bought up all the local bonds and stocks; they have bought up a majority of the American securities, and have bought

up all the Russian securities. Now they have more money for investment, net proceeds, after improving their farms and such expenditures as were needed for the better education of their families; as a net result of their operations, they have more money from their harvest than the Georgia farmer makes from his gross receipts. That is the instruction of one generation, because the first pupils who went through the schools are not young men and women, and only for eight or ten years have they taken hold of this matter and pushed it along, but see what wonders have been accomplished in those ten years.

I stand before you and say with all the sincerity of my nature that if proper attention is given to these schools, in less than 28 years the net proceeds of our farmers will be greater than the gross receipts are now. I believe if the present peach crop had been handled to the very best advantage that human ingenuity could have contributed, the net proceeds of this peach crop would have been more than the gross receipts are now. I feel safe in saying that the net proceeds of the peach crop were less than one-fourth of the gross sales, and if this crop had been handled like it might have been handled, under the most systematic, business-like methods, the net results would have been more than were the gross sales. This is one of the needs these schools should fill. Men are taught to investigate these questions, how these things should be done, and the only way you are going to get it done is by training them in their youth, by arousing their enthusiasm while they are forming their ideas of enterprise, push and application.

These schools can do this for the horticulturists of Georgia. They can take the harmful insects, and grass seeds, and weed seeds that are now so hurtful to your orchards, and can turn them into poultry and other farm products that will be as great in value as is now the net proceeds of the orchard. They will take that summer grass that comes on after you have stopped the cultivation of the orchard, and turn it into enough pork and mutton to pay more than the crop from your orchard. It will teach a spirit of co-operation, of organization for self-interest and for the interest of society, a general interest that is not now known to the people. With the experience fresh in mind of the several hundred men in Georgia to-day who are not satisfied with what they realized out of their peach crop, you might call a meeting of these men to arrange that matter so it would not occur again, and not ten per cent. of them would go about the meeting. They must be taught that only by co-operation and organization can these things be managed and controlled for the interest of the producer.

You take the California fruit grower, and if he was thrown on his own responsibility to handle his fruit crop, as the Georgian is to-day, nine-tenths of them would have to quit business. While their fruit

growing lands are paying them 20 and 25 per cent. on valuation, in some cases ten times as great and sometimes 100 times as great as the valuation paid on our lands, it is the result of thorough and complete co-operation. If the peach grower of Georgia was thoroughly organized, and if he conducted his business in the same business-like and systematic way as does the peach grower in California, the peach crop of Georgia would, as I say, yield more net profit than has been the gross sales for the peach crop this year.

These are some of the needs these schools should fill. We go to Kentucky and Missouri and even as far west as Oregon and Washington for our horses, and yet I believe a horse can be raised cheaper in Georgia than in any other state in the United States. I believe it will take less of a man's muscle to raise a horse in Georgia than in any other state in the Union. Well, until we teach these boys how to do that, we can never hope to stop that heavy drainage of millions of dollars annually going to other states for farm stock.

To try to compute what these schools should save to the horticulturist by teaching his neighbors to keep down such breeding places as will develop pests, that are harmful to orchards and gardens, this one feature itself, if there were no other, would be ample for the sustenance of these schools and the demand that they be maintained at a high degree of efficiency. One man with an old hedge row of plum trees infested with the San Jose scale may so infest my orchard that after a few years I become so disgusted that I have it cut down, whereas he might have cut that hedge down in half an hour. This is the case with a great many other insects and diseases that attack the crops and fruits which we cultivate. These things should be taught, these needs supplied, and these objectionable features removed.

I think that as important a need as we can fill is to teach the agriculturist, the horticulturist, or any man who makes his living from the soil, to know and feel that his avocation is high and noble, and that he is entitled to as much respect as any man who follows my profession. He should be taught that his day's labor is worth just as much in dollars and cents and is just as valuable to the world as is the labor of the lawyer, the doctor, the merchant or any other man. That he should command as much for his hire as they do, and that the world can more easily get along without their day's work than without his. The farmer's labor is priced cheaply because he so prices it himself. He will tell a day laborer, "Well, I can not pay you for your work what they can pay you out there on the public road, or what they can pay you on the railroad, and over there in the gravel-pit." Why? Because you under-value your labor and fix that as the value of his labor. Labor should be treated as of as much value of any other

class of work and should be paid accordingly, and it will be when the farmer realizes how that day's labor can be used from the time cotton is planted until it is laid by; he can afford to pay a dollar or two dollars, or be able to pay double the price of the man who hires him to work on the railroad, or in the shop or wherever the man wished to work him. If you use the proper amount of brain in planning work for that hand, you can pay more than any other class of work. Then when you are working between June and October, it would be other lines of work that would be short of labor. But when it takes six day's work to chop, hoe and plow an acre of cotton from the time it is planted to the time it is laid by, then we must divide that by six. But with proper work we can make that one day's work instead of six, and pay the hand six times as much. Until we realize that intelligence will bring our profession up to a point where it will be of as much importance and as much value in dollars and cents as any other avocation, we can not expect to attain our proper position among other men. This is one of the most important things these schools should teach.

What I have said applies to the boys. I have not the time to say what I would like to say about the girls at these schools. I would not go back to the antiquated ideas of the Chinese, who think girls need no education, who think that girls are only a necessary evil in the world. I say it with all sincerity that, while we have no direct expression of the fact from God himself, I believe He first started with the lower animals and went on to perfection, and that woman is as far ahead of man as man was ahead of the next lowest order of being. If we should have our country blossom, let our country know that boys and girls advance more rapidly when brought together. Friendly intercourse and relationship between the two will be conducive to the good of all of them. If any of you here have doubts as to the success of these schools as co-educational institutions, I beg of you not to express them, but give the school a chance to show what it will do. If there is only a limited space in the schools, I say the girls should have it rather than boys.

The PRESIDENT: As we are not to have a night session, we will now have to take up the business assigned for that session. I will therefore ask Mr. Earle to read his paper. Prof. Earle has been connected with agriculture in Alabama and other places, and is now in Cuba.

# The Agricultural Conditions in Cuba

BY PROF. F. S. EABLE, Herradura, Cuba.

*Formerly of the Alabama Experiment Station and the New York Botanical Gardens.*

As your President has just stated, for many years I was quite closely identified with the agricultural interests of the South, and on previous occasions I have had the honor of addressing this body on topics associated with your work. But as I wrote your Secretary, I feel that I have gotten so far away from the work here that I do not feel that I can trespass on your time. However, I will say a few words to you about the agricultural progress that is being made in this country that is so near to you but that in a way has always been shut out from the knowledge of most Americans.

The agricultural interests of Cuba could be placed under four heads: Banana culture, the raising of pineapples, the raising of truck and the Citrus fruit industry.

Bananas are not grown in most parts of Cuba, but have been confined to certain regions in the Northeastern part of the Island, where the rainfall is much greater than at Havana, for instance. Even here, the winter temperatures are too low, and the fruit produced is not as satisfactory to the trade as that brought from the coast and Central America. Therefore, the fruit country is devoting more of its land to the sugar industry and decreasing the raising of bananas.

Pineapples, while not grown especially extensively in Cuba, are constantly increasing in importance. There has been no great rush into the pineapple industry, but it has been found profitable. It is a sure and regular crop. Pineapple planting has been largely confined to the Province of Havana, but now it is extending to Pinar del Rio Province. The most of this planting is done on red lands—this sugar-cane land which is very fertile. The pineapple usually does not succeed on stiff lands, but in this case they are underlaid with cavernous limestone, thus making a fine natural drainage. The shipment of pineapples this year will amount to over 1,000,000 boxes. This industry is largely in the hands of the Spaniards and Cubans. Comparatively few Americans have gone into pineapple raising, but they are more and more turning their attention to it.

The truck industry has originated almost entirely since the Spanish war. It was started by Americans, and is still largely controlled by Americans. That is, the packing is largely done through American houses, but at the present time a large part of the truck is raised by the Cubans, and is either sold to these packers or they handle it on a cash basis for the Cuban growers. It has also increased to quite an

extent into the Pinar del Rio Province. Those lands have such a moisture-holding capacity that we are able to grow large crops of vegetables during the dry spells. You understand, the winter is the rainy season. The vegetables mostly grown are tomatoes; then probably next in importance are onions and potatoes, also a few summer squash. Cabbages are grown to some extent for the local market only. The total shipments of truck from Cuba reach almost a million packages a year. I don't know whether the industry is destined to grow very rapidly in the future or not. So far as the winter season is concerned, we have it practically to ourselves during the months of December and January, for, as you know, the market for fresh vegetables is very limited at that season of the year. With only small amounts it brings high prices, but the markets are usually overloaded at that time of the year. Last year we had an example of that fact—the market was very unsatisfactory. However, it is an industry of considerable importance.

The citrus fruit industry is the youngest of them all, probably. Up to the time of the Spanish war there were no commercial orange orchards in Cuba at all. Fifty or sixty years ago the greater part of the oranges that came to the market here, came from Cuba. No oranges have yet been shipped from newly planted groves. Grape-fruit is unknown in Cuba. The Cubans do not like sour fruits. This industry is almost entirely in the hands of the Americans.

A year and a half ago, the Cuban Agricultural Society, at its first meeting, attempted to get some statistics on the orange and grape-fruit acreage. At that time the best information we could get was that there were 4,000 acres planted. Now, there are about 18,000. These oranges are just coming into bearing, and in a few years you will see a large crop of fruit shipped. Those of us who are engaged in that industry believe that, within a few years, it will compete very favorably with the shipments from Florida.

The PRESIDENT: To what extent are peaches cultivated in your part of Cuba?

Prof. EARLE: I might say, not at all. One or two types will grow there, but I don't think it will ever be a peach country.

The PRESIDENT: And apples are out of the question, I suppose?

Prof. EARLE: I don't think we have an apple country.

The PRESIDENT: I infer from that, that pears or peaches of the Oriental type might possibly be successful?

Prof. EARLE: Yes sir.

The PRESIDENT: Whereas those of the Persian type would not?

Prof. EARLE: No sir. Some grapes are grown there.

The PRESIDENT: Any of the European type?

Prof. EARLE: I very much doubt if they would succeed. The scuppernong grows beautifully there.

Mr. WORSHAM: Are you troubled to any great extent by scale insects in Cuba?

Prof. EARLE: Yes sir; but there are so many fungus parasites and other parasites that, so far, they have not proven very serious. In one orchard near Havana they formerly spent a great deal of money for spraying, but one of the gentlemen told me this spring that they had stopped spraying this year entirely.

Mr. WORSHAM: Have you any law regulating the shipment of nursery stock?

Prof. EARLE: We had a law which was very badly drawn, and it has not been enforced. A law has been drafted and has been on Governor Magoon's desk for several months. Governor Magoon has every power over things in Cuba.

The PRESIDENT: As Mr. Stewart desires to go away early to-morrow morning, I have requested him to address you now.

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## Address of Mr. Guy L. Stewart

United States Department of Agriculture.

### MARKETING.

The immense development that has taken place in both the truck and fruit industry has made the marketing side of it to-day the important part of getting rid of the crop. Up to within the last few

years, the proposition has been to produce the crop, and all the papers that have been read at the different meetings I have attended have been on the matter of cultivation, the use of fertilizers, the matter of pruning, etc., but now it has gotten to the point where you must find out how to market your crop. My particular work in the Department at present is confined to the marketing of the crops. I put in most of my time at the large markets of the country, such as New York, Philadelphia, Cleveland, Pittsburg, etc. That is, those east of the Mississippi river. I have not gotten into the territory west of the river. And what I want to say to-day is from the condition I have seen things coming into the markets, and to make some suggestions to improve the appearance of shipments coming into the market.

I believe that at the same time you are working to get a better price for your cotton, that you have also to learn to produce cotton cheaper, in order to make a larger profit. And so I believe in the matter of truck and fruit, that you have to get it down to the minimum cost of production, in order to make a more satisfactory profit. In the past, the whole question has been one of soil, location, fertilization, cultivation, pruning and transportation. The labor proposition has entered very largely into it also; the seed, or stock, insects and diseases. Up to the present those things are what have engaged the attention both of the truck and the fruit men. Now, it has gotten to where it is a question of how to market your product.

When you take into consideration the immense development that has taken place in truck, beginning in January with Miami and coming north through Florida into Georgia; and coming in about the same time as Georgia, will be the Gulf coast and Texas, taking in the southern part of Mississippi, the southern part of Alabama, following up the coast of South Carolina, up through North Carolina, taking in the cantaloupe section of Tennessee, where in the past year they have increased something like 80 per cent. Taking into consideration all this immense acreage, and then go up into western New York and into Maryland, and you will see it is an immense proposition to put these things on the market. The danger from such an acreage is from overproduction.

In Atlanta, the other day, I learned from figures that 43 per cent. of the peach crop went to New York and Philadelphia; nearly one-half of the whole crop went to only two markets. You must not have wanted other markets. There are many small towns that will pay a much better price than where there is an immense glut on the market. Sometimes New York gets 60 or 70 carloads of cantaloupes in a day, the consequence being that they sell for practically nothing. One of the ways that I believe you are bound to come to, in the proper distribu-

tion of fruit, is by perfecting some sort of an organization, to know where you can ship your fruit, and know where other men the same day are shipping their fruit. I was over in North Carolina in the cantaloupe shipping section. The day I got there the railroads refused to accept cantaloupes and watermelons unless the freight was prepaid, and the next day refused to accept them even if the freight was prepaid, because there was such a glut on the New York market.

I was in Cincinnati when the first of the Georgia peaches began to come in. If you could have been there and seen the peaches that were shipped in there from Georgia, you would have been ashamed to acknowledge that you were from this State. They were so green that I expect I could have taken one of them and knocked the plaster off of that wall. The commission men were selling them at 90 cents a crate, and I expect the shippers were cursing the commission men as being robbers.

This year the Georgia cantaloupes were very poor in taste. I want you to understand right now that I am not saying these things because I have something against Georgia, but because these matters of absolute truth are not usually told. I saw Georgia cantaloupes come in there that were hardly fit to eat, and the same thing was true with peaches. That was not true at all times, of course, but I just happened to catch it at that time. The Georgia cantaloupe was being shipped in an ordinary crate. Here is a point that is worth your consideration. Instead of the two corner slats coming together, there is an opening, and the fruit on top crushes that at the bottom partly through that opening, thus bruising it. The California crates are made close. The weight of the fruit in the Georgia crate will, as I say, crush those melons right down through that opening until they begin to break out at the opening. The California cantaloupe, on the contrary, was coming in with the corners of the crate closed. Every cantaloupe was wrapped, and they sold at a very much better price.

I live in Washington. I think Col. Brackett will bear me out when I say that a majority of the people in Washington live in flats. We like peaches and cantaloupes, but we haven't room to put in a whole crate, and we would be disgraced if we were seen carrying home a paper bag of peaches or cantaloupes. The California people are now making a small crate which will hold nine ordinary size cantaloupes or about twelve of the smaller ones. A number of commission men in Cincinnati told me they couldn't get as many of those crates as they had calls for. They are small, of a convenient size to handle, and people like them and will buy them when they would not buy a few and carry them home in a paper bag. I believe if you will put up your choice fruit in smaller packages, you will get a very much better

price for it. It is better to ship a less amount if you can get a better price for it.

Another thing that I would call your attention to is work that is being done in Col. Brackett's office, in Washington, regarding the picking and packing of fruit, particularly those that have to go through in ice. As a general thing, it has been found that 10 per cent. of the apples shipped now show some bruise, or stem puncture, or finger-nail puncture. That puncture makes a very important opening for anything to get into the fruit. We found, by count, in a number of cases, that apples as ordinarily handled will run 10 per cent. bruised or punctured, which makes a definite opening for disease. More care must be exercised in the picking. For first class fruit to be A-1 when it gets onto the market, must be handled very carefully, like you would handle eggs. As for the packing, it is harping on an old, old subject, but I believe if you will go to the market places and see for yourselves, you will appreciate the fact that care in packing can not possibly be overdone. The best packed apples that I have seen on the market were invariably bringing the best prices. I have seen coming in from different sections of the country, bags, baskets and crates of fruit that, instead of having been put under cover, had been left out in the rain. Some of them were splashed with mud, and of course that decreased the sale price of the article.

If you should be on the market when the California apricots, cherries and plums come, just notice the perfect little packages they use for them. A man out in western Maryland had a small orchard of apples. However, he took 42 selected apples and put them into a 20 pound box, and they netted him \$1.00 a box. He was very careful about the kind of package he used.

Down in Texas they use a basket carrier for their tomatoes; on the coast they use a 6-basket carrier; in Texas they use one-layer deep. From Norfolk and some of those sections I have seen them ship tomatoes in bushel baskets. Now, you know that the weight of a bushel of the fruit will itself crush the lower ones. It is a common thing to see cucumbers come in in sugar barrels. That will spoil the lower layers. In talking with the General State Agent of the Southern Express Company for the State of Florida, last winter, when most of the spring shipments were over, he told me that using that half-barrel hamper for cucumbers, snap beans, peas, lettuce, etc., that they had to replace just exactly 7,000 packages in Jacksonville alone. That was where a transfer was made from one road to another. He said they had to replace 7,000 of those packages because they were so flimsy you couldn't look hard at them without their breaking down. Many express messengers are not very careful in handling such packages. I think the express

wagons used for transferring tender fruits should have good springs. In some sections, especially in Virginia where they have plenty of natural stone, the pavement around the depots is made of natural hewn stone. They load up a wagon and drive across that pavement, and the jolting and shaking does an immense amount of damage. I think the shipper should take pride in putting up a package that won't break when it is handled.

I kept watch in Cincinnati, in July, on peaches and cantaloupes as they came in. It just happened that the Georgia peaches were coming in, and I kept count of the broken packages that I saw. I was at one commission house two days, and did not see one broken package of cantaloupes or peaches, but I did see a number of Georgia crates that were broken, and I took some pictures of those Georgia crates showing the label.

Another thing that I believe would add largely to the profits of the shipper, would be for him to visit the market himself. You will find the commission men are not all thieves. Go and talk to them; I believe it would be good for both parties.

There are some lines of industry that I believe could be developed in this section which I believe would pay well, even lower than this in the State, and one of those would be the raising of early apples for the market. At the present time you can go into the Washington market with apples. I have been there every day, and haven't found an early apple that I would have. Another thing is the development of canneries. Another is to find some profitable manner of disposing of your peach crop. In some places they are preparing dessicated vegetables, and are putting them up in a small box about the size of a typewriter-ribbon box. Into that can they put enough dessicated vegetables to make soup for eight men. I think one of the first things for men raising fruit or truck in this State to do, if they are not already doing it, is to go to the market and see what the market wants and how it wants it put up. For instance, Washington will handle some kinds of apples and will refuse to buy other kinds. The Washington market will buy a certain kind of package and you couldn't sell that same package in Cincinnati. If you are going to cater to the Cincinnati market, say, it is up to you to supply them with what they want.

I think it will come to the time when you must perfect some organization for the handling of the Georgia peach crop, so that there won't be 43 per cent. of it going to New York and Philadelphia, or to any other two markets. You must remember also that there are other people who are shipping peaches to market, and if you will ship your cars to a place where there is a scarcity of the fruit it will be of great benefit to you. I believe some of those small Pennsylvania and West

Virginia cities, ranging from 15,000 to 40,000 people would consume a great many car loads of peaches and give you a good price for them.

Mr. LONG: I raise a few pears for market, and I learned recently that some shippers are packing them in crates just like peaches and getting fancy prices for them. Have you seen any in the market that way?

Mr STEWART: Yes sir.

Mr. LONG: Is your observation such that you would recommend that?

Mr. STEWART: Yes sir. If I were going to ship them I would rather ship them that way than in barrels. The East Shore people use a three-eighths cone-shaped basket for their pears. What kind of pears have you?

Mr. LONG: The Kieffer and Le Conte.

Mr. STEWART: There is a large class of people who live in the cities who will take home one of those small baskets. They can not take home a crate, and they will not take home a bag, for whatever reason it may be.

Mr. LONG: Did you notice any particular market where pears were put up in crates that way?

Mr. STEWART: I think I saw pears put up that way in nearly every city. My experience has been that Cincinnati takes more readily to smaller packages than any other place.

Mr. STRANAHAN: What would be the matter with bushel baskets with tarpaulin tops for those pears?

Mr. STEWART: They are sold that way very commonly. But, as I say, if you are sending to market only a choice article of fruit and are catering to people who want that particular kind of choice fruit, they are not going to buy it in that size package, and they are not going to let the retail commission men put some smaller amount up in a paper bag for them.

MEMBER: We shipped several carloads of Georgia peaches to the East in bushel baskets this year, and we got better results from them than we did from crates—got more money for the peaches. The peaches went through better in baskets.

Mr. STEWART: I don't believe you could put that bushel basket on every market.

MEMBER: Every market we shipped them to was satisfied with them. We had peaches that went to Cleveland; they were held seven days after they came out of the ice, and they were perfectly sound. Next year we shall not ship a single peach except in baskets.

Mr. STEWART: You know, all the West Virginia peaches are shipped in baskets.

MEMBER: Our crates cost us twice as much as baskets, and we can use the rawest kind of packer with a bushel basket. We sent a small sample of half-bushel baskets to Boston, and they said we could get a much better return out of those baskets for the reason you suggest, that a man will take a basket under his arm and carry it home.

Col. FORT: I grow a few Le Conte pears here. I shipped 27 baskets of those pears. The baskets held a little over half a bushel each. I got a check for \$35.00 for them to-day. I shipped 92 baskets of apples to Jacksonville to-day.

Mr. STEWART: That is the five-eighths basket?

Col. FORT: Yes sir. I shipped them to Jacksonville for people who like pears and have none, and I obtained a high price for my pears.

The PRESIDENT: There is a subject that has frequently come before our Society and before all fruit growers, and that is the influence of climate and soil upon fruits. It is a very difficult question to answer, but it can be answered, provided a great deal of observation is used. Prof. McHatton has devoted a great deal of his time to this subject, and will now give us the benefit of his observation.

# Climatology and Soil in Their Influence on Fruits

By PROF. T. H. McHATTON,  
Georgia Experiment Station.

*Mr. President and Gentlemen:*

Accept the assurance that it was with a great deal of pleasure that I received the invitation to address the Georgia Horticultural Society; yet I feel that it is somewhat of a presumption for a young man to attempt to read a paper, if I may say so, before the battle-scarred veterans of the fruit industry. It is more my place to sit and listen than to occupy your time with old stories. I will not promise to say anything that you have not heard before, yet I hope in the discussion that will follow many points of interest may be brought out.

I regret to say that the effect of climate and soil upon fruit is a subject on which we have very little definite data. There are a few things that we know from observation, yet when we come down to the fine point of the why and the wherefore it has not as yet been worked out. And on the other hand, every man thinks that his section raises the best fruit. For example, if I should say that North Georgia produces a better peach than South Georgia all of my friends from Marshallville and Fort Valley would immediately think that I did not know what I was talking about, and vice versa. To be thoroughly familiar with the subject, one must have studied the conditions of, and, if possible, been in, all the fruit growing districts of the country, for it is out of the question to find the multifarious types of soil and climate in one place. A paper of this kind will naturally fall into two divisions: first, the effects of the soil, and, second, those of the climate.

Soil, as we all know, is formed of disintegrated rock, with an admixture of organic matter. The kind of rock broken down determines the type of soil, both chemically and mechanically. We need not deal at any great length with the chemical constituents, as it is known that nearly all soils, except pure sand, contain enough plant food to sustain life; still, often one particular element is in excess of the normal and when that is the case we may safely look for some marked effect upon vegetation. Our main theme for the present must be of the mechanical characters, as it is easy for one to pick up a handful of soil and tell whether it is clay, loam or sand, whereas to find the chemical element requires a laboratory and a technical education. We also know that there is a co-relation between the mechanical type and chemical make-up.

Let us first consider the clay, our heaviest type. Its fundamental element is aluminum, the particles are small and capable of holding large quantities of water. The main effects of a heavy soil are to give a long-

lived, large tree, retard ripening and prevent too luxuriant a growth. Very few fruits, indeed, are adapted to the heaviest clays; practically the only one is the pear, and it is a question whether it does not do better on a heavy loam. There is one clay soil, however, which has been found especially adapted to peaches, and that is the Cecil Clay of Georgia. There may be a tendency to put on growth too late in the fall, and for the ripening to be retarded, and yet you get a larger, longer-lived tree and a very superior fruit. This soil is commonly known as red, or mulatto land; the surface is about 10 inches deep, of a heavy loam and the sub-soil is a red clay.

Taking up next the lightest soil, we know that on the pure sands practically none of the tree fruits are adapted. Peaches and possibly citrus trees thrive better on very light lands than any other. A mixture of sand and clay makes a loam, the amount of the composing elements, determining the type, whether clay, sandy or medium. It is upon these soils that we find the greater number of fruits, and therefore have more of an opportunity to study the effects of this type.

We will deal with the soil as affecting the peach first. It is known that the tree attains a greater age upon the heavier loams. It, however, bears sooner and the fruit ripens earlier on the lighter, sandy soils, though on the latter they both deteriorate more rapidly. It is thought that a mellow loam will produce finer, richer-flavored fruit than other soils, though the best color, as a rule, is found on the sandy lands, with the clays giving the poorest. These conditions will not hold true, though, for all localities. Take a few examples for instance: The soil survey of Cobb County, Georgia, states that the Cecil Clay produces a larger, better-colored and shipping peach than sandy loam, though the yield is not as great. The Henderson strong loam, a soil of the same district, being a sandy loam for about 12 inches, then a gritty, red clay, produces an excellent fruit. Going to South Georgia near Fort Valley, we find that the Orangeburg sandy loam, surface of 15 inches, a loose, gray, sandy soil, with a sub-soil, of red, or sandy clay, is the prime fruit land, giving the best yield, flavor and finest looking fruit of the section. Oftentimes a chemical will predominate and effect the fruit perceptibly. Too strong an alkali or acid will produce death; on the other hand, an element in excess may give satisfactory results. Col. Felix Corput tells me that whenever an orchard is located on a soil rich in iron or manganese that the fruit colors up in an exceptionally fine manner.

The plum, which we might say is the second tree fruit of importance in this State, differs greatly from the peach in its soil requirements. This fruit and the apple are most adaptable and seem to be affected less by soil than any of the others. The American, Domestic and Miner group

prefer a clay loam, upon which they are healthy, producing large crops of fine quality and flavor. The Japanese do best on the friable loams, and the hybrids are treated after the manner of the parent which they resemble most. It was impossible to find data in regard to the color, rot resistance, shipping quality and flavor of plums on various soils. We have not been able to do any work along this line at the Station for the single reason that we have only one type of land there and that is Cecil Clay.

In the northern part of the state we find quite a number of apples, and in time they may become one of Georgia's important fruits. The apple seems to be less affected and will do better on a greater variety of soils than any other fruit unless it is the American plum. The longest-lived trees are found on the heavier soils; a favorite is a stony loam of calcareous nature. It has been found that calcium or lime will help the keeping qualities of this fruit. The test was made on the York Imperial. Whether the same effect would be produced on other varieties is a question. A stony loam on a gravelly sub-soil has been observed to give the largest and best-flavored fruit, and Baldwins on a sandy or gravelly soil color up better and ripen earlier than on others. Light soils, however, are apt to produce too soft a growth of wood, which is liable to winter injury; on the heavier soils the wood is harder and usually passes through the cold season better.

One particular example of the effects of given soil which is applicable to Georgia is the soil upon which Albemarle or Newton Pippin is produced. The Porter's black loam gives the most superior apple in every respect with a crop each year. This soil is found in the mountain coves of the Albemarle region of Virginia; it also exists in the northern part of this state, around Dahlonga, Blue Ridge and Copper's Creek. We likewise have the elevation for this fruit, which, however, will be spoken of later.

We need only mention the pear, as it has not attained any great prominence with us. This fruit thrives on heavier soil than any of the others, the lighter lands making too rapid a grower which is susceptible to blight. It has been found that of all the fruits the pear will stand more alkali than any, and the heavier the soil, the greater amount of alkali does it take to injure it. It might be said in passing that the danger point of alkali for vegetation in the arid districts is about .05% and that .1% is almost sure death.

I do not know whether it would be wise to speak of the grape under the present condition in the state, or not. Suffice it to say that warm, well-drained soils give an extra quality of fruit; gravelly land causes early ripening, and dark humid soils give too much growth. It has been noticed near Fredonia, New York, that the Dunkirk sandy

loam gives large yields of low quality, which are also poor shippers. The Dunkirk shale loam, on the other hand, gives sweet, tough-skinned grapes which are exceptional for wine and shipping, though the individual berries are small. On the whole, it is thought that a light, gravelly soil; one not quite rich enough for corn, makes the best grape land.

Having said as much on the soil effect and adaptability as time will allow, we will now pass to a discussion of climate. By climate we mean meteorological changes taking place in the atmosphere, such as temperatures, rain, humidity and wind. The effects of temperature are in many respects obvious. Heat forces the protoplasm into activity, while cold stops it or holds it back. The effects of more cold than a tree is prepared to stand at any time during its life are well known. The buds may be killed in the dead winter, the crop may be ruined at blooming time or after by frost. The growers of Georgia know these things too well to be told about them.

Now, have we any way to determine the temperature limit of the distribution of various fruits. On Page 54 of Bulletin No. 10 of the Biological Survey, U. S. Department of Agriculture, we find the following:

"The northward distribution of terrestrial animals and plants is governed by the sum of the positive temperature for the entire season of growth and reproduction, and the southward distribution is governed by the mean temperature of a brief period during the hottest part of the year."

Does this help us in determining how far north or south a given fruit may be grown? Not at all, for temperature is varied so, through altitude, exposure and the like, that each fruit must be separately tested to find out whether it will live and prosper in a given locality or not. As a general rule, fruits are of better quality as one approaches the equator. This, however, does not hold true for the apple, for it improves in every way as it goes north. It is thought by some that the moderately warm days and cool nights of New York, Michigan and localities further north, just at the time apples are ripening, helps to make them color up. How much of this is true, no one can say. It is simply a theory. We know that in the north fruit trees are usually larger and longer-lived than in the south; and that a fruit of late season becomes earlier and earlier as it approaches the south, until finally a winter apple, if it can be successfully grown near enough to the equator, becomes a summer fruit.

The less the extreme of heat and cold, seemingly the better the fruit as to health, vigor and regularity of crops. This is shown by the condition of orchards near large bodies of water, which bodies equalize the temperature. Another point of interest is the effect of slope on tempera-

ture. A northern or western exposure always gives late maturity, whereas an eastern or southern slope hastens growth. This is of especial importance where we are apt to have late spring frosts.

Let us take a definite example of temperature effect. Hoffman concludes, after many years of investigation, that there is a definite amount of heat necessary for a tree to attain a given phase of its year's growth, that is, the sum of the positive maximum temperatures of a thermometer fully exposed to the sun, from January 1st to any definite time, as blossoming, ripe fruit, etc. is the same for each year. In other words, we have a thermal constant that will satisfactorily coincide from year to year. Now this season at Experiment we were some ten days ahead of last year and still, we did not have the warm weather in the winter. Why was it so? The mean maximum temperature for March, 1907, was 75.03° F., for March, 1908, was 76.02° F. Not so much difference; that came in the next month, April, 1907, the mean temperature was 67.70°. There was only one day of 80° and that was the 30th, whereas in April, 1908, the mean maximum was 75.03°, there being eleven days ranging from 80° to 84° and seven of these came before the 15th of the month. These temperatures were taken in the shade and are therefore only relative. However, we may safely attribute our early season to the seven hot days that came before April 15th, 1908.

Has the theory of the thermal constant been of any practical service? Not as yet, but if at some time it is worked out for the majority of varieties we will be able to tell in a measure where a fruit can be grown and when to expect it to ripen.

Our next consideration will be rain. Too much water causes death, as does too little. Dampness also renders the trees more liable to attacks of fungi and other diseases; it produces too much wood and in other ways injures the crop. The greatest danger from rain comes at blooming time; it prevents fertilization by diluting the secretions of the stigma, dampens pollen, oftentimes causing it to burst. Cold rains are much more injurious than others.

In sections where rain rarely falls during the growing season, such as the arid regions of California, and where the proper amount of water is given through irrigation, there is an exceptionally fine looking and shipping fruit produced. The humidity is low and the temperature high, which seem to be conducive to the formation of a firm and good-colored product.

Cloudiness, a factor that goes hand in hand with rain, also produces its effect.

Referring again to the arid regions: They have about 230 clear, sunny days a year, which are mostly during the growing season, whereas with us there are something like 150, being scattered from

January to January. It is a pretty well acknowledged fact that the amount of light and sun a fruit gets while growing has a marked effect upon the color. Some sections have had a good example of this this year, as rain has been scarce in some parts of the State and the fruit exceptionally well-colored in those localities.

Wind is another factor in fruit production that is often spoken of, but about which nothing much is known. High winds, of course, blow off blossoms and fruits, injure trees and in other ways affect the orchard. I have noticed, however, that in sections where the best fruit is produced there is usually a moderate breeze blowing; the air is continually stirring amongst the trees. Now what effect has this? We have no scientific reason to believe that it has any outside of giving air drainage, which is a frost protection in the early season, and I would like very much to get some data upon this subject, if possible.

Now I observed this year at the Station, where our prevailing wind is from the West, that the fruit on the Western side of the orchards had the highest color. I would like to hear from some of the growers on this point and see if our experience coincides.

Now just a word as to elevation with special reference to the Newton Pippins. These apples are produced to perfection in the mountain regions of Virginia at an elevation of from 1000 to 2000 feet, the best fruit being found at about 1500 feet. We have the Porter's black loam, the elevations and practically the same climate in the mountains of this State, and if there is anything in soil and climatic adaptability we would certainly be able to produce as good apples as in Virginia. The other effects of elevation need not be mentioned, as they are the same as going from South to North.

In conclusion, I would like to say that of late years it has been thought that climate had some effect on the sterility of fruits. In the Eastern parts of the United States many varieties are ranked as infertile, whereas the same varieties are fertile, or nearly so, in the equitable climates of California and England. Most of the work done on the effects of soil and climate has been casual observation. There is a large field for experiment in the adaptability of varieties of fruit; and likewise a study of the direct effects of climate and soil would be extremely interesting.

The PRESIDENT: In regard to the catalogue of fruits, does anybody wish to name any new fruits that have not been catalogued?

Col. WADE: I have one peach that I think has become generally known. It is called the Forosa. It is quite an early peach.

Mr. LONG: A neighbor told me of one of his old darkies who wanted him to write a letter to a friend in Macon. He asked the darkey the name of the friend, and he told him; he then asked him what street he lived on, and he said he didn't know; he said just to put on the envelope "Inquiring letter." As I understand it, this is an "inquiring meeting," and I want to ask what is the proper method of planting pear trees. I have found that where my Le Conte pears come next to Kieffers, they rarely ever fail to have something of a crop. Col. Fort puts his every other tree, but it seems to me that proportion is a little too large for the Kieffer, and I would like to ask if any of the gentlemen present have any information on that subject. There is no question in my mind that if you want to make your Le Conte pear crop any way certain, it must be in proximity to the Kieffer pear, because with heavy rains while the LeConte is in bloom you are almost sure to have no crop if you have no Kieffers close by. What I want to get at, is how few Kieffers can be put with the Le Conte to give us a sure crop. Pears are getting to be quite a large and valuable crop in our section of the country.

The PRESIDENT: That is a matter for a biologist. Our station horticulturist ought to be able to give you that information.

Mr. L. A. BERCKMANS: Five per cent. is what I use.

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## THURSDAY, AUGUST 13, 1908

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The session was called to order at 9:25 o'clock A. M. by President P. J. Berckmans.

The PRESIDENT: The first paper we will have this morning is one by Prof. Akerman.

# The Horticulturist's Interest in Forestry

BY PROF. ALFRED AKERMAN,  
University of Georgia.

*Fellow members of the Horticultural Society:*

Last year at the meeting in Augusta I had the pleasure of addressing you on the subject of forestry. I am indeed glad to appear before the Society again this year, to speak to you on another important phase of this subject.

The topic that has been assigned to me is, "The Horticulturist's Interest in Forestry." The first thing to suggest itself in this connection is cheap and suitable material for boxes and crates. I am not in the business of gardening for the market and can not speak from personal knowledge, but I am given to understand that the expense of providing convenient and attractive packages is increasing and will probably continue to increase as the supply of cheap, good lumber decreases. I suppose that the quantity of wood made into veneer may be taken as some sort of an indication of the growth of the box and crate industry. The statistics compiled by the United States Forest Service and the Census Bureau indicate a decided growth in the veneer industry, especially in Georgia. This, then, is one point at which the horticulturist's interest meets with that of the forester; for it is the forester's aim to supply a sufficiency of good, cheap material to all that need it. In this instance, the demand is for red gum, yellow poplar, cottonwood, and any other woods that are light in weight, easily worked, and that have no odor or taste that will be imparted to the fruit. Pine, though largely used, is sometimes objected to on this score; for it contains considerable resin.

Another point of meeting for forestry and horticulture is in the matter of wind-breaks and shelter-belts. To what extent these benefit the Georgia horticulturist, I am unable to say. There are several present who can doubtless discuss that part of the question from an authoritative standpoint. I do know, however, that in the prairie states of the Central West the horticulturists have found timber belts on the North, West and South sides of their orchards and gardens to be of great benefit. The claim is that such belts protect from the cold winds of winter and prevent too great surface drying in the summer. Of course, our climatic conditions are different and we shall probably never feel the same need for protection of this kind as our less fortunate brethren, during such weather as the dry season through which we have just passed. I have wondered, however, whether shelter-belts might not prove of considerable value in checking extreme surface drying which works a hardship on the shallow-rooted plants.

There is one point against the general use of shelter-belts. It was introduced by Mr. Hale at our meeting last year. The woods seem to furnish a breeding ground for some kinds of insects which spread thence into orchards. When such is the case, the shelter-belts must, of course, be sacrificed to the more important consideration.

A third point of meeting for horticulture and forestry is in securing dependable labor. Last year one of the papers read before this society was on the "Trials of the Fruit Grower." One of these trials the author of the paper reckoned to be the scarcity of labor. Another member introduced a resolution in regard to labor. It seems to be a common trial. I heard of it in Connecticut, in Massachusetts and in New Hampshire. In discussing this question, a shrewd New England farmer emphasized steady employment as a means of holding good men. Perhaps if he had our shiftless negro to deal with, he might think differently. But, be that as it may, I don't see myself how anyone can expect to pick up good, steady laborers and dismiss them again at will. A steady man, white or black, must have steady work and regular pay. You know they say in Washington that the reason why men work so hard to get to Congress is not because the pay is large, but because it is "mighty regular." Now the point which I wish to make before this society and which I have brought to the attention of many farmers, is that work in the woods may be done at times when work in the fields and orchards is at a standstill. The two dovetail nicely into each other; and if a farmer, or orchardist, or gardener is fortunate enough to have a portion of his land under woods he has a means of employing his labor at odd times. Even if he makes only a small profit, or if he makes back only expenses, he is the gainer, if thereby he can keep together a force of dependable hands, ready for the time when perishable crops must be moved quickly, or be lost.

A fourth common point between forestry and horticulture is found in the relation that horticulture bears to the utilization of the land. Horticulture is, in a general way, an intensive form of agriculture. It is garden culture. It implies care, skill and concentration, and it also implies large yields per acre. As population increases, supplies of food and clothes must decrease. We must, therefore, make the same land produce more as time goes on, or we must clear more land and put it under cultivation. The general tendency of agriculture nowadays is toward intensive cultivation, that is, towards horticulture. I, as a forester, rejoice to note this tendency; for it means that effort is being directed toward making the land already cleared produce more, instead of the rapid conversion of forest into field. It means that a large area will be left for timber crops.

Sometimes I hear people say that the foresters wish to retard the development of the country, because they wish some land to be left

in forest. The contention is that the land ought to be cleared and cultivated, the clearing of land being synonymous in their minds with development. Nothing could be further from the desire of foresters than the retardation of the country's development. On the contrary, we are contending for a higher development. We are contending for the careful use of all the land, both cleared and uncleared. We urge that the intensive forms of agriculture be applied to the cleared land, and that care and effort be bestowed on the woodlands.

The tendency toward intensive cultivation will tend to reduce the rate of clearing in the future. After more than a century and a half of occupation by white men, only about one-fourth of this state is in cultivation. The last census placed the wooded area at 71%. It is true that some of this wooded area will be needed for fields and gardens, and that it ought to be cleared; but the indications are that the rate of clearing will be slow. There will be at least 50% of the area of the state left for forest crops for many generations to come. This is an area sufficient to produce all of the timber needed in the state and a surplus for exportation, provided that the principles of forestry be applied to it. The average production of wood in the German forests, for the most part under the care of foresters, is 49.32 cubic feet an acre a year. If we should do as well in Georgia on the present wooded area, we would produce 1,325,721,600 cubic feet a year, and if we allow only four (4) board feet to a cubic foot, we would produce 5,302,886,400 feet in board measure. The census Bureau reports for the year 1907 only 835,697,000 feet, board measure, cut in Georgia. Granting then, a great reduction in our wooded area, we could not only continue our present output, but we could increase it, if we do as well as the Germans have done, and there is no reason why we should not. Our people are slowly, but surely, waking up to the possibilities of forestry; and in the light of German experience, I take a hopeful view into the future.

Nearly all of you own some woodland. There is hardly a farm or orchard, or even a truck garden, without some woodland attached. Taxes must be paid on this land and the owner is also out the interest on the money which it represents. Forestry, to the landowner, is a means of making his holdings as productive as possible, in order to pay taxes, interest, and secure a profit on the investment, as well as to accomplish some of the indirect results which we discussed. In this connection it might be well to consider briefly some of the methods of perpetuating woods and of increasing their productivity. The first thing to be considered is reproduction. Forest stands can not be perpetuated without a success of seedlings and saplings any more than communities of people can be perpetuated without infants and youths.

Reproduction is a *conditio sine qua non*. In some parts of the country, notably in the prairie states, the founding of a stand is a large problem in itself. It requires considerable outlay of money and effort to get an acre of forest started. We are more fortunate here in Georgia. Nature has blessed us with such conditions that reproduction is easily secured. The mast is plenty and it germinates freely.

But, while Nature has been good to us, we must remember that Nature must be given a chance. We must keep the fires out if we want reproduction. Fires burn up the seeds and they kill seedlings and saplings. When I was here in Cornelia in June I made that statement before a Farmer's Institute; and I was told afterward that it was challenged by some one in the audience. I do not know the particular reason why my statement was challenged; I only know that one of those who heard me went away and said I was wrong, that fires do the woods good instead of harm. I was also informed that a Swiss who happened to hear the remark took up the cudgel for me and told my assailant that in Canton, Zurich, where he grew up, that a fire in the woods created quite as much alarm as a fire in town, and that everybody turned out to fight it.

I am ready to admit that in some rare cases where there is too much litter on the ground, that a fire may aid reproduction, by exposing the mineral soil so that the germinating seedlings may readily take root; but such cases are exceedingly rare. So far I have not met with one in Georgia.

Another source of detriment to reproduction is grazing. The larger animals, like cows and horses, do not harm reproduction to any great extent, unless the range is crowded. The chief injury is caused by trampling and breakage. Horses and cows browse the trees only to a small extent.

Hogs do considerable damage to reproduction. They eat a great many seeds. They root up seedlings in search for other food; and they root up and devour the roots of some kinds of tree. Those of you who come from the South Georgia pine country know the appetite that hogs have for the roots of the long leaf pine. Hogs should be excluded from the woods if reproduction is desired, or at least they should be allowed to run only at intervals.

Here again I am willing to admit that some good may result. Under certain conditions, hogs may aid reproduction by mixing the leaves and humus with the mineral soil, and thus preparing a good seed bed. This is well known to European forest practice, and is taken advantage of; but once the seed bed is prepared, the hogs are excluded until the young stand is firmly established.

Sheep and goats are most injurious animals. They eat everything. They have been universally declared against by foresters. It is impossible to secure reproduction unless they are excluded. Once an owner asked me to visit his farm and examine his woodlands. He did not state the nature of his farm until we were nearly there. Then he explained that his farm was a goat farm, and that he had got me to come to tell him how to raise trees and goats on the same land. I told him I could advise him right there without going further. He would have to give up his trees or his goats.

These things that I have mentioned are rather negative—the exclusion of fire, hogs, sheep and goats. There is a positive treatment that many owners in Georgia can follow, and that is thinning. By thinning is meant the removal of a portion of the trees in a growing stand to improve those that remain. Do not confuse it with the removal of the final crop. Trees, in order to prevent large side limbs, and to stimulate height growth, should stand close together during the early stages of their development. But if allowed to remain too long, they begin to injure one another. The stimulative competition that has gone on among them becomes a destructive competition. Theoretically, this is the point at which the forester should step in and restore the balance. Practically, he is limited by market conditions. Thinning is not practicable, except where the material removed can be sold for enough to pay for its removal. If it only pays for its removal, thinning may be practiced; for then the improvement to the stand is a net gain. If there is a balance above expenses, why so much better. Even in those parts of the state where there is no market for inferior material, the owner can at least take out his firewood and fence posts in the form of thinnings.

To sum up, the horticulturist is interested in forestry, because the two lines meet at the following important points:—

1. Material for crates, boxes, etc.
2. Shelter-belts.
3. Means of keeping a force of laborers together.
4. Horticulture means intensive cultivation and slow clearing of wooded lands, and forestry means the best use of the land left uncleared.

Col WADE: The Professor spoke about crate material. One of us is wrong about the matter, and I want him to right it,—and that is, that pine is not a fit material for our crates. I have never seen personally, among the many hundreds of crates that I have used, the least fault with them. The Georgia Crate

Company, of Thomasville, make their crates entirely of pine. They are perfectly satisfactory. I even felt so well about it that I wrote to the house, and they furnished the crate to a good many of us here. We are just on the verge of trying to start a crate factory here. Of course, we can get some poplar, but we have to use pine mostly for our crate factory. I would like to get straightened out on that matter.

Prof. AKERMAN: As I said, questions of that kind can be much more intelligently discussed by those in the shipping business. I only know I have heard some complaints. I do not see how the pine could do any harm unless it was in contact with the fruit. I am sorry I have no more definite information on the subject.

Mr. McHATTON: I am very much interested in this question of fire in the mountains. I am familiar with mountains—not so much in this section, but in others. I can almost safely say there is but one uncut body of timber in those mountains, and that is about fifteen acres in extent. We haven't a fish there to-day. The muscallonge that came up the river, is gone; the mountain trout is gone; the timber is gone. The people say that the Indians put fire in the mountain woods to bring up the grass the next spring. Now the hills are being washed away. After a short rain, the water is as red as brick. The fish can not live in it. But the people will insist on putting fire in the woods. I recall an open field that for several years the fire was kept out of, and to-day there is as pretty a stand of white oak saplings there as you ever saw. How are we to stop it?

Prof. AKERMAN: That is a very perplexing problem. The people in the mountains will not only continue to set these fires, but they won't believe it when you tell them they will be sorry afterwards for doing it. They are taking hold of that same kind of situation in Minnesota, Massachusetts, Texas and New Jersey.

I think we ought to have better laws in regard to fires. The laws of this State are not specific enough, and we have no definite machinery behind them to enforce them. Of course, we have the old common-law, that you can not injure your neighbor,—but we must have a better law, with a Fire Warden behind it, to see that it is enforced.

I am glad Mr. McHatton brought up the question of fires, because it is so important. We abuse the lumbermen, and say they are destroying our forests and are the evil of nearly all our woes. I don't believe the lumberman is half as much to blame as the man who sets the woods afire.

Mr. WIGHT: The post question is getting to be a very important one with us. I would like to ask if you know the results of trials of *Catalpa Speciosa* for that use?

Prof. AKERMAN: I have looked into that a little bit, but the information I get is not very encouraging. The catalpa is a good tree; it makes a post sometimes in eight years, sometimes in ten. We should remember that we have so many better trees, that we don't have to fall back on the catalpa. I have tried a little catalpa to see what it would do. In some sections we have chosen the white oak. In South Georgia you have an excellent post—when you can get it—of long leaf pine. Where you can not get that, you have the lob-lolly pine, and the short leaf pine can be used if you treat it with creosote to the amount of 15 cents per post, and it will last you from fifteen to twenty years.

Prof. ROGERS: What would be the cost of fitting up some place for treating second-growth pine posts with creosote, as you suggest?

Prof. AKERMAN: I heard of one plant that was fixed up at a cost of about \$45.00. I am sorry I can not give you the figures from personal experience.

Prof. NEWMAN: I think the very best post is made of the black locust. I have heard it said that they last forever,

and then turn to stone. Ordinarily, the cattle strip the bark off the trees in the mountains in the spring, and the result is that more timber is destroyed than all the cattle in the whole section are worth.

The people in the mountains set fire to the woods in order to get rid of the old grass, and have new grass ready for the cattle in the spring. If there were some means of preventing turning loose cattle in the mountain ranges, all the trouble would be prevented. I have lived in the Blue Ridge for a long time, and have studied that question. I have known men to drive cattle five miles to get to a place where there was a pasture, and they will tear down fences to get there. You can not control those people at all. The only way to prevent these forest fires is to prevent these cattle ranging in the mountains.

The aesthetic viewpoint is important to me. I am willing to drive 40 miles any spring day to see the wild flowers growing in these mountains. Last spring I drove through large areas of these mountains. On one side of the road, where fires had been, you wouldn't see a flower, and on the other side, where there had been no fire, you would see hundreds.

Col. WADE: In answer to the question of Mr. Wight, I want to say that I have raised catalpa trees some fifteen or twenty years in my life, and I think the *Catalpa Speciosa* makes the best post in the United States. I can grow catalpa posts at a cost not exceeding one-half cent each. All through the Northwestern States they are planting catalpa where the freeze is not too excessive. To get the regular *Catalpa Speciosa*, there are only four or five firms in the United States that will sell you the right seed, even if they know the right character of seed. I think this would be a fine opportunity for Prof. Akerman to help us get some of the correct seed and have them planted at the universities. I know the locust is a very valuable tree.

MEMBER: You can plant locust seed, and they will grow several feet in a year.

Col. BRACKETT: I want to say a word in regard to the *Catalpa Speciosa*. In 1862 I was through the country where the earthquake of 1811 occurred. I found a *Catalpa Speciosa* that had been thrown down by that earthquake in 1811, and it had lain there ever since, and was in a state of perfect preservation. It is one of the most durable woods that you can find. There is another species of wood that is fully as valuable, and that is the Osage orange. I have used it for stakes, and there is no decay to it. It is very easily grown.

Judge LONG: A few years ago I was in Texas, at Denison. Soon after leaving there, you will find thousands of miles of barbed wire fence of this Osage orange. They call it Bois d' Arc. In Dallas, Texas, I noticed where they were cutting into the street, there was a different curbing on the sidewalk. I asked somebody what it was, and they said it was Bois d' Arc. I think, if we will watch it, we can make thousands of posts out of it. In our section of the country there is a great deal of it. They will take a piece not more than twice as large as my arm, and make a post out of it.

There is another suggestion that I think is germane to this question: Have any of you had any experience with using cement posts? Some friend has suggested that they would make fine posts.

The PRESIDENT: We have considerable business yet to be attended to, and this subject will have to close.

I see Mrs. Erwin in the audience, and I will ask her to favor us with her paper.

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## Home Surroundings

By MRS. EVA. G. ERWIN, Cornella, Ga.

When considering this wonderful subject of horticulture in the interest and promotion of which we meet to-day, it sometimes seems to me that no more daring work was ever undertaken than that of sup-

plementing the work of Nature, and we should, indeed, approach it seriously, not to say reverently.

In this state of ours, whose soil and climate make its possibilities of beauty and its resources for beautifying almost limitless, there is needed only the lively, loving workers to make it the State Beautiful. Oh, for a Luther Burbank in every state in our union who shall elevate the life of the horticulturist, bringing his work to the recognition of the masses, teaching them to see in every tree, shrub and flower something to love, improve and perpetuate.

Perhaps in our own little town, nestled down among everlasting hills, we have, as in few others, a setting, a background which should call out our best endeavors to show our appreciation of our surroundings, appreciation in the highest sense which always resolves itself into some constructive evidence.

Let us not, by making our individual tastes too much in prominence, mar in any way what Nature has done for us. Let us first of all strive for harmony and contrast, for herein lies the secret of success in our endeavors.

I often think we do not realize what wonderful power we have in creating harmonious environments for ourselves. I am such a believer in this theory that I think much of our success is due to harmony and much of our failure to lack of harmony.

You who have given this subject no thought may question it; for the sake of my argument, analyze your feelings some day when you see flowers, for instance, that you dearly love, in a setting in which they are entirely out of place. Then, by way of contrast, analyze your feelings where you see an ideal beauty spot in some unexpected place. Note how much each influences you and make up your mind which you would rather have for the permanent condition.

So my first plea is for harmony, some arrangement that is restful to the soul and body, not the rest of stagnation, but the rest of aspiration, the rest which Goethe immortalized when he said:

"Rest is not quitting  
This busy career,  
Rest is the fitting  
Of self to its sphere."

We must remember that we have a rugged, massive, imposing background; let us try to have our home surroundings in keeping.

Inasmuch as we have rocks in our midst, why not make them contribute to our interests; they are surprisingly effective, and especially so when covered partially by some vine, say the ivy, whose deep, rich green lends itself so well to half-revealing, half-concealing the bare, gray

rock. In a corner, in the center of the lawn, by the porch, anywhere a rock may chance to be, in just that spot will it add dignity to the landscape. I have seen the dwarf nasturtiums planted about the edge of a rather flat rock, and the contrast of red and gray has again been effective. If there is a side slope and it be possible to arrange three or four rocks with an approach to regularity in the form of steps ascending this slope, the result is marvelous, but in this case always have a rock or two at the side to outline the step and have these covered with vines or flowers.

In our locality shrubs should play an important part in the landscape gardening. If you have some corner for which you have not provided, try massing shrubs with a little pink or white spirea in the foreground. Our varieties of spirea are many and beautiful. In white, the low-clustered, gray-leaved Himalayan is considered the finest, and in pink, the flat-clustered *Spiraea Pulchella*, a hybrid that is supposed to owe its beauty to two Himalayan species, also since it combines the broad cluster of expensa with the brighter color of bella. The South is fortunate in being able to grow the plants of the India Mountains, and when the gardening Renaissance comes to us, it is said that we will look to the Himalayas for floral treasures, as the North has looked to Japan.

If we must have fences, especially at the back of our homes, we can conceal almost entirely, making of the "necessary evil" living fences. It takes little time, care and expense to plant a honeysuckle as a screen, and yet for this service how soon we are repaid by a wealth of green leaves in abundance, of dainty blossom and an odor that it is a perpetual joy to breathe into one's nostrils.

For ornamentation, every post and bit of board should be covered, where possible, with some vine. The morning glory adapts itself well to most surroundings, and the deep and brilliant blossoms make every morning a fresh delight.

Don't make the mistake of having all the flowers at the front of the house. With a large yard the back offers undreamed of possibilities. A bit of "back-door" decoration which is simple to arrange, yet gorgeous in its breath of yellow, especially if it can be set in front of trees, is a yellow pyramid. Select a giant Russian sun-flower for the center and apex, surround it with the seven-foot varieties, and this with the five-foot, and so on, until you have left the miniatures and dwarfs for the last circle. Always leave as much space as the yard will admit between the circles and in order to carry out the scheme perfectly exercise care in planting that the pyramid may be uniform. Thus the end will justify the means. If we can have our pergolas and summer houses, let us do so by all means. They are such a comfort as well as

ornament, but let us avoid planting them in the center of the lawn; but rather place them on the sides or in a corner, as if they grew there from time immemorial. Have a background of trees to gain the most effectiveness: if this is out of the question, a good bit of shrubbery may be substituted.

Good imitations of the Japanese stone canterns can be made in wood, and one or two on a lawn do wonders in giving it a really distinguished appearance. Try to give shrubs and trees room enough to cast shadows over the lawn. This is a feature of gardening which is generally overlooked.

For those who can not indulge in landscape gardening to any extent, the flower-bed is our standby. It is a temptation to scatter these over different portions of our grounds, but here again we must remember that in massing and grouping we gain effectiveness. For border beds, particularly the perennials, afford no end of delight, and the selection will depend on whether the gardener desires his flowers for appearance, fragrance or cutting. A very economical plan is to plant the flowers one wishes for the house among the vegetables, thus permitting better effects and more space in the garden. In our immediate section, the coleus and nasturtiums will give unexpected returns, with but little care and almost no expense. Pinks, whites and yellows are not so warm looking as scarlet, but who does not love vivid, flaming blossoms? Many growers are supplanting the old scarlet favorites with salvia, because it likes the rain better. It looks washed after a shower instead of needing to be washed.

I have observed that the gardens proving the greatest success and attracting the most attention are those in which one variety predominates. This should not be carried to the extent of a fad, nor to the exclusion of others, but, to some extent, be famous for your roses, violets, poppies, or some handsome or favorite flower.

I have not so much as touched upon the bulbous plants nor flowering shrubs and trees, with which we are so bountifully provided in our State, but I must say just a word of the Camellia, whose centenary in this country occurs this year. Let us pay our respects to it anew, and our allegiance, for nothing can be more beautiful.

In the main, our soil is rich and our seasons long. With loving care and study these children of Nature will develop as do the human flowers of our households; but like these human flowers they need to breathe, eat and drink, and we must know how to provide intelligently for their needs.

I can not close without speaking of the broader field in which we have to work. Our interest must extend beyond our own hedges. For what do beautifully kept lawns and gardens signify if the streets and high-

ways are all kept untidy? We must remember that the town is the setting for our own individual gardens as the gold is the setting for our gems.

First then, as horticulturists, let us crusade against every form of untidiness in our streets; let us make it abhorrent to our children; when we have done this, let us demand good roads and neat, well-kept sidewalks. This accomplished, we may seek to beautify by cultivating odd bits of land belonging to the town. However, there is a broader interest even than our town; let us be in the forefront with those who are fighting for the reclaiming of our swamplands and preservation of our forests.

Trite as it may seem, I must repeat our time-worn words, "Let us not be weary in well-doing." Is it too much to expect that our enthusiasm will bear fruit, even to the hundred-fold standard? I think not.

Enthusiasm is contagious, as are all virtues if we put ourselves in the way of "taking" them, and because of our enthusiasm let us make our surroundings so beautiful that our boys and girls will find their home towns too attractive to leave for the crowded city streets. They will find, perchance, that in the cultivation of the soil lies potentialities of which we have not been cognizant.

We have outgrown the old-time idea that the uneducated farmer and workman are the only tillers of the soil. To the educated agriculturist and horticulturist the earth is waiting to yield treasures of which we have no conception. It is not too much to say that the future of this nation lies very largely in what the soil produces. Let us make this belief so vital that our boys and girls will be among those who bring to pass my prophecy.

The PRESIDENT: The aims of our organization are for the higher education of our people, and, on behalf of the Society, I wish to thank Mrs. Erwin for her most interesting and valuable paper.

I will ask Mr. Staight to give us his paper on apple culture.

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## Growing Apples in the Highlands of Georgia

By H. R. STAIGHT, Demorest, Ga.

On the growing of apples in the Yonah Land Section of our grand county, Habersham, I am going to speak briefly as possible of my personal experience; not that the apple is the only fruit that succeeds here,

for peaches, pears, plums, grapes, strawberries and many other plants are as much at home in our soil and salubrious climate as the apple.

In the year 1895, I purchased a small tract of uncleared upland, which was quite rough and hilly, one mile from Demorest and three miles from Cornelia. I had the timber cut and burned from part of the land, and set about 700 apple trees. Three hundred of these were Shockley, 200 Yates, and the remainder were composed principally of Heslep, Winesap and Terry, and the rest composed a few each of about 18 different varieties for testing. They were not fertilized and owing to my time being taken up with other business, did not get any fertilizer until six years of age, and only very indifferent care; in fact, for two years I let sedge grass and sprouts almost take possession of things. My health failing me on account of close confinement to business, I disposed of my other interests, moved on my land, and from that time until the present I have given the trees my personal attention, practicing clean cultivation, fertilizing, pruning, spraying, etc., and increasing my planting from year to year until I have now about 20 acres in apple trees.

I have never had a complete failure any season since my trees arrived at a profitable bearing age, but, on the other hand, have always had crops paying a fair profit in the poorest years. My present crop on the original planting is variously estimated at from 2500 to 3500 bushels of apples.

Not having had any experience in the care of orchards previous to my first plantings, I of course made mistakes, but determined to make a success of it as much on account of almost everyone's in the neighborhood prophesying my utter failure, as any other reason.

I began the close study of methods of successful orchardists in other sections, secured bulletins bearing on the different phases of apple culture from stations located in the greatest apple-producing States, studied these closely, and appropriated all that seemed best for our section.

Terry heads the list of heavy bearers, but is lacking in color somewhat. In 1906 this variety paid me at the rate of \$408.00 per acre, when apples sold for a dollar and a half per bushel; this on eleven year old trees. One tree bore 18 bushels of perfect apples. In this year of bumper crops, it would be a different problem to pick out the heaviest bearers, as they are all over-loaded with fruit.

The Georgia State Commissioner to the Jamestown Exposition obtained the entire state exhibit of apples (over thirty varieties) out of my cellar, a part of which, however, were grown in the orchard of Mr. Heskett. Our apples keep well up to the first of March, usually with a loss of 10% from decay. Apples from Habersham County always

capture first prize at the State Fair. This all goes to prove that we not only can, but do, grow fine apples in Habersham County.

In October last I visited G. H. Miller and Son, of Rome, Ga., with whom I had been in correspondence in regard to planting a large commercial apple orchard near Demorest. I took with me some samples of apples. Mr. Miller was so favorably impressed that he and Mr. R. H. Black (formerly of Wisconsin) visited me in December following, examined the fruit in mine and Mr. Heskett's cellar, looked at our orchards, and before leaving bargained for 400 acres of our best fruit lands, 4 miles from Demorest, and arranged a stock company, capitalized at \$20,000, and with Mr. Black (who owns a large share of stock and is an experienced man) as manager, work was begun clearing land and planting trees; 10,000 of which were in the ground by last March. The remainder of the trees will be planted as fast as practicable, and, so far as I can learn, this will compose one of the largest, if not the largest, apple orchards in the South. In connection with this, we are planting an experiment orchard, which will compose four trees of each of the standard varieties of apples for testing as to their adaptability to our soil and climate. Besides this large enterprise, many smaller commercial orchards are planted and many more are in process of planting, ranging in size from 1000 to 7000 trees. I am informed by people who have been there, that our country is very much like the great apple growing regions of the Ozark Mountains, especially in texture of soil and lay of land, as well as climate, etc., and I am going to prophesy that at no distant day our Yonah Land Country will become noted as a great apple producing region, where as fine fruit will be grown as anywhere in the country, and, in order to reach our markets our competitors will have to ship their products hundreds of miles, while we are at its doors, and no one can better appreciate this great advantage than we fruit growers who have to turn the lion's share of our profits over to the transportation companies for freight and express charges. With our cheap lands and nearby markets, I know of no branch of husbandry which offers more sure returns to the man who understands his business than does commercial apple growing in the hills of Habersham County, Georgia.

Col. FORT: Tell us your system of fertilization.

Mr. STAIGHT: In planting the trees, the first requisite, I think, is to excavate a good, large hole to plant them in—something like 3 feet square. In my plantings now, I use about two pounds of bone meal to the tree, and I get from 2½ to 3 feet of growth a year. I think the cultivation means more than fer-

tilizers to bearing trees. To bearing trees this year I used a fertilizer that analyzed about 7 per cent. phosphoric acid and about 12 per cent. sulphate of potash. My trees are putting on a fine growth, notwithstanding they have a very heavy crop of fruit.

The PRESIDENT: Do you train your trees with high or low bodies?

Mr. STAIGHT: With low bodies. I try to train them about 18 inches from the ground. A few years ago I got some trees headed about 3 feet high.

The PRESIDENT: Are you troubled with leaf rust?

Mr. STAIGHT: Yes, I am, on some varieties. The Shockley seems most susceptible to that. I have sprayed a great deal, but I don't seem to be able to altogether control it.

The PRESIDENT: The Shockley is known to be a bad citizen in the orchard for leaf rust, especially if you have any cedar trees in the neighborhood.

Mr. STAIGHT: I had all those cut down.

MEMBER: How many times do you spray?

Mr. STAIGHT: I sprayed 3 times this year. I think the first spraying for that leaf-rust is very important. After the trees leaf out, I use as a spray 3 pounds of bluestone and 6 pounds of lime. I put in double the amount of lime to prevent burning the foliage. For the codling moth, I sprayed them with Disparene and clear water. I did it so thoroughly that it did not require a second spraying.

The PRESIDENT: Did you commence as soon as the fruit was set?

Mr. STAIGHT: No sir, I sprayed when the blossoms were about three-fourths on the ground. I sprayed from the top of the tree down. I think as much depends on the way the spray is put on the tree, as anything else.

**MEMBER:** Do you spray before the tree blossoms?

**Mr. STAIGHT:** I sprayed with lime-sulphur this year.

**The PRESIDENT:** Mr. Worsham, we would like to hear from you now.

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## Report of the Past Year's Work of the State Board of Entomology

By E. L. WORSHAM, State Entomologist.

It has been the custom for a number of years for the Entomologist to make a report to the Horticultural Society on the work of the State Board of Entomology. As it would consume too much time to go into all phases of the work, I shall touch upon only those features which relate directly to horticulture.

### INSPECTION WORK OF THE BOARD AND ITS VALUE.

One of the most important features of the work of the Board is the inspection work, both orchard and nursery inspection.

The system of inspection inaugurated with the establishment of the Board, and the enactment of laws regulating the shipment of nursery stock, has been instrumental in keeping our nurseries up to a very high standard and made it possible for growers to purchase only stock free from dangerously injurious insect pests. It is unfortunate that this work was not begun earlier than it was, before San Jose scale was more or less generally distributed, but the work which has been done has meant much for Georgia. Georgia can now grow a peach crop which will net her growers something like four million to six million dollars, and, in the language of one of Georgia's prominent growers, if it had not been for the work of the Board of Entomology there "would hardly be a peach tree in Georgia." By keeping in close touch with the growers through inspection of orchards from year to year, giving advice concerning the treatment of trees for various pests which infest them, the majority of growers manage to keep their trees in fairly good condition. We have always complied with all requests for special inspections, and each year do a great deal of inspecting where requests are not made, but where we can assist the growers. About 300 orchards were inspected during last year, and scale found in many of them for the first time.

This phase of the work means much for the growers of the State, and they should always make requests for inspection of their orchards

whenever there is any trouble whatever in which the Board could assist.

Our law has been strictly enforced in regard to requiring parties to remove orchards which are hopelessly infested and where they are unwilling to adopt remedial measures which we recommend.

Our system of nursery inspection is as thorough as any in the United States. When a nurseryman receives our certificate, it is a guarantee that his stock is free from scale.

The continued interest in the fruit industry is demonstrated by the number of nurseries which continue to do business. The number to receive certificates this year will be 85 to 90, and they will have for sale about five million fruit trees. Eighty-five certificates were issued last year to nurseries outside the State. Figures from the Agricultural Department show that there are now 13,000,000 bearing peach trees in the State. Many trees are dying annually from old age and lack of proper attention, but I think figures will show that there has been a steady increase in the number of trees which come into bearing each year. From inquiries which were received by the Department last fall and winter, it is evident that orchards are receiving more attention than heretofore.

#### SAN JOSE SCALE.

San Jose scale continues to be one of the most important pests with which fruit growers have to contend, and it continues to receive a marked amount of attention from the Department each year. We are conducting experiments each year and striving to find remedies which will be more satisfactory than those we already have.

The pest was introduced into California more than thirty years ago, and was brought east by New Jersey nurserymen in 1887. It was introduced into Georgia from New Jersey in 1889. We also have evidence of the fact that it was later introduced into Georgia by California nurserymen. In 1897 scale was present in eighteen counties in South Georgia; in 1904, in about eighty counties in the State. It has now been found in about one hundred counties of the State.

The U. S. Bureau of Entomology has made a very careful investigation of the history of the insect and has located its original home in China. A careful study of this insect in its native home revealed the fact that it was there not a serious pest, and this was due to the presence of certain insect enemies, principally the Asiatic lady-beetle. Immediately an attempt was made by the U. S. Bureau of Entomology to introduce these beetles into the United States. They were brought to Washington where colonies were reared and distributed in various parts of the country. Some of those sent to Georgia were placed in an or-

chard at Marshallville where San Jose scale was very abundant. The rapidity with which these beetles multiplied together with the very voracious appetites they possessed, seemed to indicate that they would be of great economic importance, but the cold winter combined with the application of insecticides was too much for our Asiatic friends, and their stay with us was of short duration. It is quite probable that they have entirely disappeared by now, for we have not been able to find a single specimen for the past two or three years.

#### FUNGUS DISEASE OF SAN JOSE SCALE.

Under certain conditions, fungus diseases of insects have been of some economic importance. We have no better illustration of what fungus diseases will do along this line than in Florida where the large amount of rain during the summer months and the very high humidity make conditions ideal for the development of all fungi of this nature. In certain sections of Florida, it would seem that certain scale insects are practically held in control by fungi. Among these the San Jose scale, Long scale and Round scale, and also the citrus white fly which has gotten to be such a serious pest in oranges. In case of the white fly, I had opportunity to experiment with the fungi which attack it, while located in Florida. I found that at certain times and under certain conditions the diseases attacking it were of great economic importance. I found that in nature these diseases amounted to a complete remedy about once in three years. Up until the time I began work on the problem, no means had been devised whereby these fungi could be disseminated in such way that they could be of economic importance. It required such a long time for the fungi to develop and spread over a tree that the white fly would do a considerable amount of damage to tree and fruit before the fungi accomplished anything at all. I devised various means of disseminating the spores in order to get fungi started on all parts of tree at same time, and the one which seemed to give the most satisfactory results was one where I got spores in solution and mixed with small quantities of commercial gelatine and sprayed the solution on the trees. This is one of the methods that we employed in our experiments with the Red-headed fungus on San Jose scale. We hope to determine definitely whether or not these fungi can be made to be a factor in controlling scale in Georgia. As Mr. Lewis will touch upon this in his paper, I will not attempt to go into further detail.

Natural enemies have not been of any appreciable economic importance in Georgia in controlling San Jose scale. If we depend on natural enemies, we have to depend on them alone and not apply insecticides.

Results thus far obtained seem to indicate that scale will do a considerable amount of damage to trees before the fungi develop to the point where they can be of value in reducing the scale.

#### SOLUBLE OILS.

The growing use which has been given various soluble oil preparations against the San Jose scale and the conflicting reports as to their efficiency, was thought to be worthy of investigation, and experiments with the better known and more commonly used brands were conducted at Goggins.

Conditions favorable to a thorough test of these materials were found in an orchard at this place. The orchard selected was young and badly infested with scale, and had never been sprayed at all. Experiments were begun in October, 1907, when the fall treatment was applied and completed in February, 1908, with the spring treatment.

It was desired to find the comparative merits of fall and spring sprayings and if any difference existed, to find which spraying would give the better result.

The test included six brands of soluble oils, as follows: Kil-O-Scale and Soluble Petroleum, both manufactured by the Thomsen Chemical Company, Baltimore, Md., Target Brand Emulsion, manufactured by the American Horticultural Distributing Company, Martinsburg, W. Va.; Schnarr's Compound No. 1 and Schnarr's Compound No. 2, manufactured by the J. Schnarr Insecticide Co., Orlando, Fla., and Scalecide, manufactured by the B. G. Pratt Company, New York.

Each of these materials with the exception of Scalecide was given a trial at three different proportions, viz: one gallon of mixture to twenty of water, at one to fifteen, and at one to ten. Scalecide, recommended by the manufacturers to be used at a strength of one gallon of oil to fifteen of water, was used at this strength and also at two greater strengths, viz: one to twelve and one to ten. All of the materials were thus tested at three strengths and in three ways; fall treatment, fall and spring treatment combined and spring treatment alone. Two examinations were given this work, the first on May 29th and the second on July 30th.

As the results of these tests are soon to be published in bulletin form, only an outline of them is here given.

Particular attention is called to the fact that the percentage of scale killed was in every case much higher for the fall sprayings than for those applied in the spring.

#### TARGET BRAND.

This emulsion shows conflicting results that can not be accounted for. At a strength of 1 to 20, the fall treatment, applied November

12th, gave excellent results. The double treatment at the same strength also gave excellent results. But the fall sprayings at strengths of 1 to 15 and 1 to 10, respectively, yielded decidedly inferior results when compared to the 1 to 20 plats. Double treatments at 1 to 15 and 1 to 10 practically destroyed all the scale. On July 30th, only a few live scale could be found on trees sprayed with Target Brand at these two strengths. There can be no doubt that this compound was properly mixed and the trees thoroughly sprayed. Every tree was completely covered, care being taken to wet the smallest twigs, as well as the body and limbs.

The spring sprayings, applied February 20th, yielded poor results at all proportions. On trees that were badly infested at the time of application, the summer breeding of scale was scarcely checked at all. It must not be taken that this material was not at all beneficial. Not sufficient scale was killed, however, except by the fall spraying at 1 to 20, the double treatment at the same strength, and the double treatments at 1 to 15 and 1 to 10, to keep the new infestation from reaching very undesirable, and in most cases, dangerous proportions.

#### SOLUBLE PETROLEUM.

The fall sprayings of this oil at proportions of 1 to 15 and 1 to 10, respectively, gave highly efficient results. The fall spraying at the weakest proportions, however, viz: 1 to 20, was not effective. On July 30th, the date of the last examination of plat, an abundance of living scale was found on the leaves, and some on the limbs and twigs. The double treatment at 1 to 20 killed practically all the scale.

With this material there was a suspicious dying out of trees in every plat where it was used. It can not be stated positively that the oil was wholly responsible for the death of the trees, as many of them were badly infested and in a weakened condition. But the evidence is to the effect that it was partly, at least, responsible. Not taking into account this feature, the results which Soluble Petroleum gave were of the highest order.

The spring sprayings with this oil were more effectual than with any of the oils used in the spring experiments. Although the 1 to 10 and 1 to 15 preparations were noticeably more effective than the 1 to 20, the latter shows good results.

#### KIL-O-SCALE.

Neither the fall spraying nor the double spraying with Kil-O-Scale at 1 to 20 were of much value. At 1 to 15, the fall spraying also failed to stop a new spread of scale this summer, although the double treatment at this strength yielded good results. At 1 to 10, the fall treat-

ment was ineffectual, comparatively, and the double spraying at the same proportion brought about nearly perfect results.

The spring treatment with Kil-O-Scale shows hardly any appreciable checking of the spread of scale. At the greatest strength, 1 to 10, the spring application gave only fair results, and at the two weaker dilutions the results were almost valueless.

#### SCALECIDE.

Scalecide is better known to the orchardists of Georgia than any of the other oils under discussion. It is probably used more in the State in spraying against San Jose scale than any other insecticide. At all proportions in which it was used in the experiment, it gave highly efficient service. The double sprayings were slightly more effective than the single sprayings, as might be naturally expected. That is, the difference between them was noticeable when the examinations were made. As a fall treatment, Scalecide is unquestionably of more value than a spring treatment. The latter in this test, was decidedly inferior. At 1 to 15, the spring application was by no means as thorough as was expected. The spread of scale has been retarded in degree, but results in the aggregate are poor. At 1 to 12, the percentage of scale killed was higher, but live scale can easily be found on all parts of trees. The plat sprayed at 1 to 10 is the only one of the sprayings with Scalecide that shows really good results. Compared to Soluble Petroleum, Scalecide worked inferior results, but at the same time it must be remembered that the former was apparently responsible for the death of a number of trees.

#### SCHNARR'S COMPOUND.

This compound is used considerably in Florida against the White Fly and scale insects affecting citrus trees. At 1 to 20, the fall treatment was rather ineffectual. At every other strength the treatment yielded results of the highest order. Between the fall treatment at 1 to 10, and the double treatment at the same strength, this material, of all others, showed no difference. The mixture was subjected to an extreme test, as nearly all the trees upon which it was sprayed were heavily infested with live scale.

The spring applications with Schnarr's Compound were an absolute failure, there being no apparent difference between them and the unsprayed check trees. This fact is undoubtedly due to a partial decomposition of the material used. The material used in the spring spraying was taken from the same can of oil used in the fall spraying. During the winter the oil seemed to separate so that only about two-thirds of it was soluble in water when the spring application was applied. The consequent weakening of the diluted mixture is responsible for the failure

of the work. From the above statements it will be seen that the fall treatments are more to be depended upon than the spring treatment. Soluble Petroleum is the only material that approached nearly identical results between fall treatment and spring treatment, and here the slight difference was in favor of the former. Irrespective of all other considerations, Soluble Petroleum gave better results in effectually killing scale than any of the oils used, though Scalecide as a fall treatment was almost identical. But between Scalecide and Soluble Petroleum as spring treatments, the latter was far more effective. Schnarr's Compound as a fall spray was almost commendable. Despite the failure of this compound to stay perfectly mixed, the results of the spring spraying can not be properly considered as worthless.

Compared to lime and sulphur, this sketch shows that it could not be more efficient against scale than some of the oils when used sufficiently strong and properly and thoroughly sprayed. But lime and sulphur possesses so many more valuable properties besides its insecticidal value that it seems more worthy of use than any of the oils thus far manufactured. Its fungicidal value, its health-giving properties, the certainty of its effectiveness, still leave it in a class by itself.

#### PREPARED LIME SULPHUR SOLUTION.

This material was furnished by the Thomsen Chemical Company, Baltimore, and recommended for trial at a proportion of one to twelve. This spray solution came too late to be included in the fall spraying, but it was tried in February, 1908, and gave excellent results as a spring treatment. This material is a clear liquid free from any solid matter and is ready for immediate use after diluting with cold water. Spraying with this diluted mixture can be carried on more rapidly than with any of the oils because of its extreme fluidity.

Results obtained from a single spraying with the prepared Lime Sulphur solution seemed to be very satisfactory. When last examination was made very little live scale was found. The results were just as good as those obtained from any of the soluble oils and the trees seemed to be much cleaner and healthier in appearance than those sprayed with the oils.

#### CURCULLIO.

The experiments which were begun in 1907 for the control of peach curcullo with arsenical poison were duplicated this year at Mayfield. Arrangements were made with Messrs. Berckmans Bros. for carrying on the work in their orchard and we desire to thank them for their assistance in otherwise facilitating the work.

The original plan was to use arsenate of lead and Pyrox in the experiments, but owing to the failure of the latter to arrive in time,

Disparene was substituted. Disparene is simply another name for a brand of arsenate of lead, but as the field plats had been laid off in advance to include Pyrox, and as Disparene was available when Pyrox was not, it was determined to make the substitution.

Both arsenate of lead and Disparene were used at the rate of two pounds to fifty gallons of water. To this mixture milk of lime made from three pounds of good stone lime was added. The first spraying was made immediately after the petals dropped, the second, ten days later, and the third, ten days later than the second. The sprayings were duplicated on Hileys and Elbertas.

Unfortunately, we are unable to give any data on the results of these sprayings beyond their effect on the foliage of the trees sprayed, and the coloring of the fruit. For some cause, the crop of curculio was very light this year, and on the unsprayed check plat, left for comparison with the sprayed plat, an extremely small percentage of peaches was infested. This of course made comparison impossible.

The results of spraying with these arsenicals, on the foliage and coloring of the fruit, mention of which was made in our report of 1907, was of value as corroborating the data given in that report. It now seems that more than two applications of either of these poisons is injurious to foliage, and in small degree to the fruit. Two applications defoliated the trees to some extent, but not sufficiently to cause sun scald on the fruit. Some defoliation is really advantageous in parts of orchards which are so heavily leafed, either from the nature of the soil or improper pruning, as to deter the fruit from gaining the maximum degree of color.

Whether from the partial defoliation of trees or a chemical action on the fruit itself, or both, the latter gains an added color that is desirable.

Below is given a table of percentages for the infested and non-infested peaches of the 1907 experiments. These figures were gained by selecting a fixed number of trees from various parts of each plat, and opening all fruit therefrom, keeping an accurate record throughout the entire season of every peach, whether infested or sound. From these figures it can easily be seen that arsenical poisons have a decided tendency to reduce infestation from curculio.

Plat No. 1.                      Arsenate of Lead.  
(2-3-50. Variety, Elberta.)

This plat was sprayed twice. All fallen fruit was opened as it was during the spring and summer and the numbers of infested and non-infested fruit kept. At the ripening period all fruit was gathered from the trees, opened, and the record completed.

This plat showed 68% sound and 32% infested.

Plat No. 2.

Arsenate of Lead.

(2-3-50. Variety, Elberta.)

This plat sprayed three times. Record was kept as above. The percentage of sound peaches was 70, infested 30.

Plat No. 3.

Arsenate of Lead.

(2-3-50. Variety, Elberta.)

This plat was given four sprayings. The record was kept in the same way as for all plats. The yield by actual count was 75% sound and 25% infested.

The check plat at the close of the season showed a yield of 29% sound peaches and 71% infested. When compared to the check, plat 1 shows a saving of 41% and plat 3, a saving of 46%. These figures show conclusively that arsenate of lead greatly reduced the number of wormy peaches.

#### CODLING MOTH.

The codling moth is, and continues to be, the most serious pest of apple growers. The enormous loss of \$11,400,000 is attributed to this insect annually for the whole of the United States.

Luckily, the larval state of the moth presents a vulnerable stage. When taken advantage of, the orchardist can almost completely eliminate the injury from this pest by spraying intelligently at the particular stage in the moth's life cycle before the eggs have hatched and the larvae have entered the fruit.

Life history work and experimental spraying with arsenicals, looking to the best control of the moth within the State, were begun in the spring of 1906 and have been continued yearly ever since. A repetition of the work has been necessary, owing to a complete failure of an apple crop where the spraying feature of the work was located the first two years. However, the life history of the moth was followed as was originally planned, enabling a more nearly accurate experimental spray outline to be formulated and tested this year.

The principal aim of the life history work was to determine accurately the number and the time of occurrence of each brood of moths, and sundry points of interest and value in connection therewith. Without a thorough knowledge of the life history of the moth, spraying to control the moth would be purely guess work, a procedure too often absolutely valueless.

The results of this phase of the work have been very gratifying. Comprehensive notes covering all stages of the moth's development have been made, and it is the intention of the Department of Entomology at the conclusion of this work, to give in detail in bulletin form the results obtained.

The spraying feature of the work before mentioned briefly consisted of a spray outline for nine plats, each to be sprayed according to a different plan and arranged in a measure to show the direct benefit from any one application or a combination of sprayings as high as four, as given in the following outline:

Lime .....	6 lbs.
Bluestone .....	3 "
Disparene .....	2 "
Water .....	50 gals.

No. of sprayings and time of application is indicated below:

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Plat 1. 1st. Just as petals fall. 2nd. Just before calyxes close. 3rd. Ten days after 2nd.

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Plat 2. 1st. Just as petals fall. 2nd. Just before calyxes close.

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Plat 3. 1st. Just before calyxes close.

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Plat 4. 1st. Just as calyxes close. 2nd. 14 days later.

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Plat 5. 1st. Just as calyxes close. 2nd. When 2nd brood appears; as eggs hatch.

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Plat 6. 1st. Just as calyxes close. 2nd. 14 days later; when 2nd brood appears; as eggs hatch.

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Plat 7. 1st. Just as calyxes close. 2nd. 14 days later. 3rd. When 2nd brood appears; as eggs hatch. 4th. 2 weeks later.

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Plat 8. 1st. When 2nd brood appears; as eggs hatch.

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Plat 9. 1st. When 2nd brood appears; as eggs hatch. 2nd. 2 weeks later.

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Check Plat. Any convenient number of trees; preferably about ten; depending on the size.

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Arsenical Bordeaux was used on all the plats. (Lime, 6 lbs.;  $\text{CuSO}_4$ , 3 lbs.; Disparene, 2 lbs.;  $\text{H}_2\text{O}$ , 50 gallons.)

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As yet we can only forecast the results of this spraying experiment. Indications point conclusively, however, that proper spraying in the early spring primarily for the first brood is all important.

#### PEAR BLIGHT.

The work on pear blight this year has been continued along the same lines as last season. That is, pruning out the disease in winter and

spring. While we have not yet succeeded in exterminating the blight in any orchard, we have controlled it to such an extent that it did not do much damage this season. In J. B. Wight's orchard at Cairo there was considerable blight this season, but the pear crop was the best it has ever been.

In the pear orchard at Thomson there was little blight this last spring; in fact, there was so little, we went over the orchard and cut it out in May. On August 5th, this orchard was examined by Mr. A. C. Lewis, and he found there was but little blight, not over fifteen or twenty trees out of a hundred being affected. The blight was late in appearing in this orchard this spring, and a good crop of pears set and are still on the trees. We intend to prune this orchard again before the leaves fall, and also in the winter and spring, and in this way we hope to exterminate the blight.

#### BROWN ROT EXPERIMENTS.

A continuation of the series of experiments against this destructive fungus disease were conducted this year at Mayfield under the supervision of Mr. W. W. Chase. Besides Bordeaux Mixture, which has heretofore been given almost exclusive trial, several new compounds were included in the tests. The principal one of these is a self-cooked mixture of lime and sulphur. This mixture has been very favorably reported on in other states and it is to be hoped that it will prove a successful remedy in Georgia, because of its comparative non-injurious effects on foliage. Two well known food preservatives, salicylate of soda and sodium benzoate, were each tested in compounds with salt, with bluestone, with weak Bordeaux and lime. The American Horticultural Distributing Co., of Martinsburg, W. Va., requested a trial of a new fungicidal oil which they have formulated, and this was also included in the tests.

Beyond what was learned as to the effect on each of these sprays on foliage, the work yielded no results of value. Although the section of orchard sprayed was selected as being more likely than any other to develop the rot, none showed during the season and the determination of the value of the various sprays as fungicides was made impossible.

The heavy financial losses which have been sustained by Georgia fruit growers from brown rot fungus and the lack of some dependable remedy therefor demands the continuation of this branch of experimental work. Until a means of controlling this fungus is devised, the work will receive yearly attention.

The PRESIDENT: If Mr. Lewis has his paper ready, I will be glad if he will read it now.

## Effect of Spraying With Lime-Sulphur Wash.

### Red-Headed Fungus as Parasitic on San Jose Scale

By MR. A. C. LEWIS, Assistant State Entomologist, Atlanta, Ga.

When I came to Georgia in 1905, there was much talk about the harmful effect of the Lime-Sulphur Wash on peach trees. Some thought that spraying the trees one year would not harm them, but if it was continued for three or four years it might greatly damage the trees. Others were inclined to think that it was dangerous to use even one season. The following cases have come under my observation where there was some injury done by spraying with lime and sulphur:

On John T. West's orchard at Thomson, in the spring of 1905, the twigs on some of the trees were killed back six to ten inches. Most of the killed twigs were on the Kennesaw trees, which were sprayed in November and again in February. The injury was confined to the tips of the tender twigs, in no case extending back more than twelve inches. No other damage to the trees was noted.

During the same spring I observed similar injury to the twigs of some Elberta trees around Ft. Valley. In some cases the limbs were killed back two and three feet. This injury was noted in several orchards around Ft. Valley. This injury was especially severe in one block of the Hale orchard. In a letter to me, Prof. A. L. Quaintance expressed himself as follows, in regard to the injury at Ft. Valley: "The block of trees treated had been forced into late growth in the fall, and were sprayed in the late fall and early winter, and before the wood had hardened sufficiently. In general, I think applications made in the spring shortly before the buds swell is safest, and, in any case, the injury from the lime-sulphur wash is not likely to be very important."

The most severe injury from lime-sulphur that I have seen was at Coleman, Ga., in 1906-7, and I think that this injury may be accounted for by the condition of the trees when they were sprayed. Col. W. D. Hammack at Coleman had a small orchard of peach trees which were very badly infested with the San Jose scale. Most of the orchard was located in sandy soil where the nematodes were very numerous, and all the peach trees were badly infested with the nematodes. The orchard had been sprayed lightly in the winter of 1904 and 1905; that is, it had been sprayed twice, but not very thoroughly, with the lime-sulphur solution. These sprayings had reduced the scale some, but they were still quite numerous in the fall of 1906. Hence, this winter, Mr. Hammack determined to give them an extra good spraying.

The winter of 1907 was unusually warm, the temperature going above 80° in January. This forced the buds to swell considerably on the peach

trees. In March after this warm weather, we had some freezing weather. This alone was hard on the trees. I saw at Coleman some pomegranate bushes that were killed by this freezing weather.

Mr. Hammack sprayed his orchard about the middle of November and again about the last of February. He also informed me that the wash was put on very hot. From the above facts it appears that the warm weather had started the flow of sap, and the buds were swelling, or had swollen considerably before the spraying was done in February. The trees were weakened by the nematode worms. The scale had also helped some in reducing the vitality of the trees. From this it would seem that the spraying had killed the trees just as if it had been applied when they were in bloom, on account of the weakened condition of the tree and the condition of the sap.

The trees looked very much like winter killed trees, but there was this difference: Many of the limbs were killed back only to the large limbs or trunk, whereas, when trees are killed by the winter, they are killed, as a rule, down to the ground.

As to the effect on the trees when the wash is applied consecutively for a number of years, we will first cite the orchards in Georgia, then some of those in other states that have used the wash for a number of years.

I have been in the state nearly four years, and know of orchards that have been sprayed every year with the lime-sulphur wash, and they are in much better condition to-day than they were when I first saw them. Col. Jno. T. West's orchard at Thomson is one of these. He has used the lime and sulphur for the past four years. The Berckmans Bros. at Mayfield have used the wash for three years with very good results. And others in the state have used the lime and sulphur wash from two to four years. You never hear of any one giving up the lime and sulphur because it is not effective, or because it damages the trees; but when one gives it up, it is because it is hard to put on the trees, and this is a poor excuse.

In California where they have been using the lime and sulphur wash for many years, no serious harm has ever been done. Prof. C. W. Woodworth, of Berkeley, Cal., in a letter to me, says: "I think you can safely cite the larger part of the peach orchards of California as evidence of the safety of the continued lime and sulphur spraying, because our orchards in many districts are annually sprayed for San Jose scale and the life of the trees in this state is two or three times as great as the average life of peach trees in Georgia."

Prof. A. L. Quaintance informs me that Prof. M. B. Waite has been using the lime-sulphur wash on his orchard in Maryland since 1904 with good results.

Prof. J. L. Phillips in Circular No. 1, New Series, of the Virginia State Crop Pest Commission, mentions an experiment in which very strong solutions of lime and sulphur were used. The following is what he says about this experiment:

"The lime-sulphur wash was used in the spring of 1905, in the Experimental Station orchards, to test whether or not even very strong preparations would injure thrifty apple, peach, cherry and plum trees. The applications were made on the 23rd and 24th of February, 1905. In these tests equal quantities of sulphur and lime were used, 30, 45, 60 and 90 pounds, respectively, to 100 gallons of water. In other tests, an equal quantity of salt was also added to each preparation.

"The application was made to the branches of apple, peach, cherry and plum trees, instead of to the whole tree. When examined on the 24th of April, only one case of injury to peach was observed, and this was where the strongest preparation (90-90-100) was used, with the salt added. There was slight indication of injury to apple and cherry by the preparation in which 60 and 90 pounds of each of the ingredients were used. The plum was slightly injured, which showed in delayed growth, where the stronger preparations were used. All trees, however, were in normal condition by June 9th.

"These results coupled with results from double treatment, mentioned in Tables 1 and 2, where no injurious effects were observed, indicate that one need not fear injuring healthy trees by spraying them with this wash.

"Dipping nursery trees at time of planting, however, appears to be a little more likely to cause injury. No injury has been noted by the writer where apple was dipped in the regular strength, but injury has been observed on peach. This is doubtless due to the added effect of transplanting. We hope to publish more fully on this work at a later date."

#### EXPERIMENTS WITH RED-HEADED FUNGUS.

The Red-Headed fungus (*Sphaerostilbe coccophila*) is parasitic on a number of scale insects in Florida, and is thought by some to be instrumental in keeping them under control, to a large extent, in that State. It is present on the Gloomy scale (*Aspidiotus obscura*) in many sections of Georgia, but only in a few instances have we found it occurring on San Jose scale.

In the spring of 1907 experiments were started to determine whether or not this fungus could be made of economic importance in controlling San Jose scale in Georgia. The fungus was introduced in several peach orchards in different parts of the state where San Jose scale was present in great abundance. The method employed in introducing the fungus was to tie pieces of oak bark covered with fungus on the

peach trees. Three or four pieces of bark were tied on the limbs of the trees that were very badly infested. The results so far secured may be summarized as follows:

On May 19th, 1908, Mr. J. F. Bates' orchard at Millen, Ga. was examined, where the fungus was put out June 27th, 1907. The fungus had nearly covered the trees, but had not spread up the limbs above the sticks that were tied on. Where the fungus is the thickest, it has killed many of the scale on the trees. On one tree, most of the scale was dead, that is, there was a small amount of crawling scale. At Waynesboro, Ga., on Mr. E. E. Chance's orchard, practically the same condition was found.

June 2nd, 1908, orchard of Mr. Nicholson, at Richland, Ga. was examined, where the fungus was put out June 4th, 1907. The scale was nearly all dead, and no fungus could be found. We can not say that the fungus killed the scale. This is a small orchard of about one hundred trees. The fungus was tied on ten or fifteen trees. The scale was nearly all dead on all the trees. When the orchard was treated, the scale was very abundant, and it seemed that many of the trees would die by another season. On the same date, several other orchards around Richland were examined, and much live and crawling scale was found. This would seem to indicate that the fungus, or some agency which was not present in other orchards, killed out the scale in Mr. Nicholson's orchard.

During the past year we have had several cases called to our attention where the Gloomy scale was damaging the oak and maple trees. In many of these instances the Red Headed fungus was present. In some cases, the fungus seemed to be getting the best of the scale, while in other cases the fungus seemed to be doing very little good. On Chas. Deckner's place near Atlanta a number of trees were seen where the Gloomy scale had been almost completely exterminated by the Red Headed fungus. This fungus seems to be well distributed over the state, hence, it will be easily obtained if anyone wishes to introduce it into his orchard.

This spring we decided to try spraying the fungus on the trees, and the following method was used: The oak sticks covered with the fungus were soaked from one to two hours in a small amount of water, then the fungus was scraped off and stirred briskly so as to break up the fungus and liberate the spores. This was then mixed with water and one package of commercial gelatine dissolved in each gallon of the mixture. Some trees were also sprayed without the gelatine.

August 4th, 1908, the trees in orchard of Mr. W. E. Jones at Waynesboro were examined, where the fungus was sprayed on May 20th, 1908. Fungus was present on some of the trees in small quantities; the

pink part of the fungus was just appearing in a few places. On the trees where the fungus was placed by tying on the pieces of bark, the fungus was not showing up very much more than on the sprayed trees. Of course, it must be kept in mind that the fungus is present on the scale for some time before it can be seen with the unaided eye. It seemed to have killed only a very few scale.

On the same day, trees in Mr. E. E. Chance's orchard were examined, where the fungus was put out June 26th, 1907. The fungus was well distributed over most of the trees. It was present on this season's wood, but live scale was also present on the same twig.

For comparison, a twig of this season's growth was taken from a tree where there was no fungus and the scale counted, with the following results: Out of one hundred scale on twig where no fungus was present, twenty were alive; on twig where fungus was present, three were alive out of one hundred, but live crawling scale was found to be just about as abundant on trees where the fungus was present as on the other trees. From the count above, it will also be seen that the mortality of the scale is very great, in this case 80% of them dying without any apparent cause.

From the experiments so far, it appears that the Red Headed fungus does not increase fast enough in Georgia to do very much good, but the experiments will be continued until we determine if the fungus can be made to become of economic importance in controlling San Jose scale.

Mr. EARLE: Some eight or ten years ago, in Alabama, I tried similar experiments with this fungus, and with similar results. I think probably it will not grow fast enough to be of any material assistance.

Mr. LEWIS: On the oak tree you can see the fungus very plainly. It comes out very thick on the scale.

Mr. Kitchen: I heard of this experiment being tried in Florida. Griffing Brothers introduced the fungus in their orchard and claim they practically exterminated the scale. I went into the woods to see what it was, and we found it in great quantities. They took the bark off in narrow strips and tied it on the trees. They claim in Florida that it practically exterminated the scale.

The PRESIDENT: We have a paper on the program on the Rotundifolia Grape, by Prof. C. C. Newman. Prof. Newman is not here, but his father has kindly consented to take his place. He is eminent in horticulture, and I know you will be interested in what he has to say.

## Rotundifolia Grape

MR. J. S. NEWMAN.

*Mr. Chairman, Ladies and Gentlemen:*

I suppose it is proper for me to make amends somewhat for the shortcomings of my son, but I am satisfied there must be some good reason for his not being here. He could give you a much better talk on this subject than I can.

We do not appreciate this family of grapes enough in the South. The South is the only place where they grow. The Rotundifolia family—the round-leaf family—is represented in our forests by the Muscadine. People have become accustomed to calling them the Scuppernong grape. That is wrong. The Scuppernong is a seedling from the black grape. We have the advantage in this family of grapes for extending the season right on to November.

I will speak of the propagation of the grape, its training, the peculiarities of some varieties and their value. In the first place, this grape has no enemies so far as I know, and I have been growing them for forty years. The worst enemy it has is its own tendrils, which frequently cut the vine in two, so firmly do they grasp it. A mistake that has been made ever since it has been cultivated, is the manner of training it. The impression has got about from nurserymen and others that you can not prune it, it must not be pruned, and that they can not be grown from cuttings. Both of those ideas are erroneous. They can be grown readily from cuttings at the proper season, and can be pruned to any extent at the proper season, but if you prune them at the wrong season you will kill them. My son cut some small vines, and it was positively astonishing to see the quantity of sap that ran from those vines. In 1892 I cut one of the vines in cutting out a road, and it absolutely made a mud-hole there about two feet deep with the wheels cutting into the dirt. We can not prune them except for a short period in the fall. At that time it is perfectly safe. Just after the leaves fall, you can prune it with impunity, but before the leaves fall it is dangerous. Other people have said that you must wait and prune them in cold weather. Two parties came to me and said they didn't know

whether I knew what I was talking about as against the views of everybody else, and they concluded they would try the other plan, and they killed all they pruned otherwise than as I suggested.

I have had these grapes on arbors, and since 1884 I have trained them on trellises, and there is no comparison at all. You get up on an arbor to gather them, and in all probability you will fall through the rotten rails that support them. But you train them on a three-wire trellis, two feet apart, and they will bear to an extent that I have seen them when it looked like if you started at the bottom with a half-bushel measure it would have been full by the time you got to the top of the vine. An arbor is a temporary affair. If you get good locust posts and good wire and put up a trellis, it will last a man's lifetime, and you have no further trouble except to prune them in the fall.

I moved to Walhalla three years ago this fall. I found one there that seemed to be about three years old. That is running now for nearly 100 feet on a trellis and bearing a full crop of grapes. I never would have gotten a peck of grapes if I had done the opposite. In traveling over South Carolina, I suppose I have spoiled a thousand arbors by explaining that method of treating them. After pruning them, put those vines on one of those wires and it looks like it just walks ahead, and in a little while you have a mass of vines. We never get full bunches of grapes if we don't prune; you get straggling bunches, and not much of those. You prune those as you do the others. You cut them back and that concentrates the force of the vine in the bunches that are left, and you get better and larger grapes. Don't cut back the green vines as they run on the trellis.

The first experience I had with that method of pruning was at Auburn, Ala. in 1884. I planted eight varieties on a trellis, and they grew and bore to such an extent that people passing would gaze at them in wonder and amazement. A mistake generally made is planting them too close together, and not giving them sufficient room. You can cut them back if necessary, but I don't like that; I had rather have long vines.

As to the propagation of the vines, you can propagate them by just putting down the cane and throwing dirt on it at alternate joints, leaving the next joint uncovered, and you can make as many rooted plants as you cover the joints. But every layer you put down is a menace to the health and vigor of the whole vine.

There are two vines at Clemson College that were propagated by two of my graduates at Auburn. One of those men is now in the Agricultural College of Mississippi, and the other is in the Agricultural College of North Carolina. I am proud of the boys I have turned out in agriculture. I was a pioneer in that line. You can find men

now, presidents of colleges, who will tell you that there is nothing to be taught in agriculture. A man wrote that to me once, and I wrote him back that a professor of chemistry, who did not know the Greek alphabet, would naturally say that there was nothing to be learned in Greek, and vice versa.

Cuttings are just as good as layers, and you don't interfere with the whole vine in the cultivation. One trouble with an arbor is that you can not cultivate it. With a trellis, you can cultivate it just as you can a row of corn.

The weeds and grass should be kept down so as to give the roots full opportunity.

Now, as to the varieties of this family, I had eight varieties growing together in Alabama, and while they were all good in productiveness I think the most productive is the Flowers. Then there is the Thomas; that is the earliest of the family. The James is a fine black grape. Also, the Memory. This makes large bunches of very large grapes, and it adheres to the bunch better than any of our ordinary grapes. You can ship them better than most grapes. Its flavor is far superior to that of the Scuppernong, and there is no trouble about the berries falling off as there is with the Scuppernong. The James has the same trouble about dropping, but it is a very fine grape. There is another which produces a very large berry, which originated in the town of Opelika, Ala. I named it the Jeter grape, because I got it from Mr. Jeter. The Mish is exceedingly sweet. Most of you people think the Ives is not fit for anything because it is too sour. If you will let it get ripe, it is one of the sweetest grapes I ever tasted. After the Mish comes the two varieties of Flowers, which carry you about to November. I have had two classes out pruning grapes in November, and they used to get plenty of grapes, even after all the leaves were gone. You must prune them just after the falling of the leaves. You can make cuttings with impunity then, and with success.

I have often told people that we live in the best part of the world. We can have everything we need in the way of fruit and vegetables every day in the year, if we only do our duty. The Lord has done His part in giving us the country, and the soil and the varieties, and all we have to do is to do our duty. You can have vegetables fresh in your garden here every day, and we can have fruit every day in the year. I lived in Hancock County, Georgia, for several years, and we never had a day that we were without fruit. We had apples that lasted until strawberry time. With this rotundifolia family, we can continue with a succession of grapes and carry them on until frost.

I greatly enjoyed the paper by Mrs. Erwin to-day, because she spoke on a subject that is dear to my heart. I have been trying to get the

country people to take care of their homes and make them attractive, and she presented that subject in a most delightful manner.

Col. FORT: I was very much interested in what Prof. Newman has said in such a practical way. I was raised in Milledgeville, Ga. We had on our place a very large scuppernong vine; possibly it covered the tenth of an acre. There is a legend about the scuppernong about which I would like to ask Prof. Newman. There is said to be one of the largest scuppernong vines in the world in Albemarle Island, in North Carolina, and the people there say Sir Walter Raleigh planted it. Do we trace all our scuppernong vines to that vine?

Prof. NEWMAN: I have never seen that vine, but in 1858 a minister who had been there and seen it told me it covered nearly two acres, and that they had made nearly 2,000 gallons of wine from that one vine.

MEMBER: How far would you put your first wire from the ground?

Prof. NEWMAN: Three feet.

MEMBER: And then every two feet above?

Prof. NEWMAN: Yes sir, and then you can gather them without any trouble. You cannot gather them satisfactorily from an arbor.

MEMBER: About how far apart would you plant them?

Prof. NEWMAN: It depends on the amount of ground you have. I generally give them about 60 feet.

MEMBER: Would you put them first on a post and wires?

Prof. NEWMAN: The first year I generally put up a stake and then I use the locust post. It does not matter whether the post is right by the vine or not. I prefer not to have it right by the vine, because it makes it more difficult to cultivate it. Put the posts about half way between, so that you can cultivate under the vine. I use barbed wire, and I

have a reason for it. In the winter when we prune our grapes we have to tie on the wire those that we expect to bear the next year. In stretching that out it has a disposition to recoil, and the winds will blow it off sometimes. It cannot do that on a barbed wire. The barbed wire is just as cheap as any strong wire, and it has that advantage.

Col. WADE: I would like to distinguish as to which of these are scuppernongs and which are the other ones.

Prof. NEWMAN: The black ones belong to the *rotundifolia* family, but they are not scuppernongs. The scuppernong is the white one which is a seedling from the black ones.

Col. WADE: Do any others of this family fruit the way the scuppernong does?

Prof. NEWMAN: Yes, the Flowers will. You cannot ship scuppernongs without picking the berries off. The James will drop off like the scuppernong, but it is a very fine grape. I don't think the Thomas falls off. Let me give you one precaution, right here: Do not have any large trees near your trellis. The *rotundifolia* family is a child of the South, and it needs lots of sunshine. So, in planting your vines, and trellising them, do not have any large trees near to give shade.

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## Intensive Strawberry Culture

By P. H. BROWN, Augusta, Ga.

While the strawberry is a plant that will grow in many varieties of soil and climate, it will do its best only when all the conditions necessary for the development of both plant and fruit are complied with.

First, location. For early bearing, select a southern exposure in order to get the full benefit of the sun. For late bearing, select more of a northern exposure. There are two conditions that a strawberry can not stand, viz: Washing away of the soil, and soil so flat that water will stand on it. The first condition can be rectified by terrac-

ing and running the rows on a level, while the second condition can be obviated by proper drainage, or when this can not be done, the land can be thrown up into high beds five or six feet wide and the berry rows set upon them. Avoid land infested with nut grass, Bermuda grass or Johnson grass. To be all the time fighting such grass adds fifty per cent. to the cost of cultivation.

**Preparation of the Soil.** All my remarks and observations concerning strawberry culture are intended for the latitude of Augusta, Ga., hence, due allowances must be made for distances north and south. My plan is to sow the land in peas and cut off for hay; then, as soon as the hay is off, broadcast with from 30 to 40 loads of manure per acre, as much as an able-bodied horse can pull. For this purpose, I prefer the manure fresh from the stable, even if coarse. Turn all under with a turn plow, eight to ten inches deep; level the ground with a smoothing harrow, but avoid harrowing out the strawey manure and vegetable matter that would rot, except noxious grass that would be liable to propagate itself. With a long, three-inch bull-tongue I cross the first plowing and then cross this. Time spent in the thorough preparation of the land is well spent and pays a big interest in the production of fruit. I endeavor to do all this work in October, and never think of setting out any plants before the middle or last of November, when we usually have plenty of rain. The strawberry will not do well on light, sandy soil, deficient in humus or vegetable matter. It is well to remember this, and also to remember that no commercial fertilizer can take the place of humus in such soils. In addition to the manure, I top-dress, broadcast per acre with 600 pounds of 16 per cent. acid phosphate and 100 pounds of muriate of potash. I lay off my rows three feet apart with an eight-inch shovel, and in this row I drill fine, well-rotted manure. Right here are a few conditions to be observed: This manure must be non-heating, preferably hog or cow manure. When this can not be had I often use a compost of cottonseed and leaf mould. Before applying to the soil it must be thoroughly cut up and mixed with hoe and shovel. Run a small bull-tongue in the furrow to mix the manure with the soil. List on this with a small twist shovel and the ground is ready for the plants.

**Planting.** The plants should be well grown with mature roots. Plants with succulent roots not fully grown are dear at any price. You can purchase better plants in November from Southern nurserymen than you can in September, because better grown. I practice both hill and hedge row culture. For hill culture I set them sixteen inches apart in the row. This system does not produce as many berries to the acre as the hedge row, but the berries are larger and pickers would rather pick large berries than small ones, besides large fruit usually commands better prices than small. For the hedge row system

of culture, the plants can be set from 24 to 36 inches apart in the row. When runners are thrown out, set a runner from each plant, one on each side, one-third the distance between the parent plants. For instance, if 24 inches is the distance between the plants, by setting a runner one-third this distance will make a row with plants eight inches apart. If 36 inches, the plants will set 12 inches apart in row.

In the matted row culture, the plants stand from 3 to 6 inches apart in a bed from one foot to three feet wide. This system is in vogue in the North and West, but not so well suited to our climate.

In setting the plants, I prefer the hand to make the hole and set the plant with roots spread out, using care not to cover the heart with dirt. Press the dirt firmly around the plant. Plants can also be set with a dibble, or with a spade. A few days or a week after setting, the ground should be stirred with a small cultivator or harrow, taking care that no dirt be thrown on the plants. After the plants get some size, a small victor sweep that runs perfectly flat can be used. During the period of fruiting, in order to avoid throwing dirt on the fruit, I run a single furrow through the middle of the rows with a very narrow bull-tongue, which loosens the ground impacted hard by the feet of the pickers and holds much of the rainfall that without this furrow would run off. The agricultural axiom, "Keep the grass out and don't let a crust form on the ground," should be impressed upon every strawberry grower.

Varieties. I am often asked what variety I would recommend to plant. This is a question hard to answer. A variety that might do well in one locality might prove a poor bearer in another place. Many varieties that are good shippers are poor for the table, and vice versa. Prolificacy in a variety is not always the best recommendation. A variety that sets more fruit than it is able to mature is not as good as a variety that sets less but brings all to perfection. A person who wants to go into strawberry culture had better first commence with a testing patch consisting, say, of six or eight varieties, embracing a dozen or two plants of each kind. From the behavior of these during a season or two a fairly good selection can be made. But don't tie wholly to one variety; some seasons a variety may fail, while another does its best. Some varieties are pistillate, that is, the bloom is imperfect and must have a staminate variety to fertilize it. Keep all runners cut off for best results. Young plants should never be allowed to bear much fruit. All fruit buds and blooms on young plants just set should be pulled off, otherwise the strength and vitality of the plant will be weakened and not in condition to

bear much fruit the coming year. In our latitude, planting can be done at any time during the winter, except when the ground is frozen.

The PRESIDENT: The next business in order is the report of the Treasurer.

Statement of L. A. Berckmans, Treasurer, Georgia State Horticultural Society, from Aug. 1st, 1907 to July 31st, 1908.

#### RECEIPTS.

To balance brought over .....	\$151.14
" interest on deposit in Augusta Savings Bank .....	4.37
" annual dues from members .....	106.00
	<hr/>
	\$261.51

#### EXPENDITURES.

Aug. 1/07 Badges and hire of typewriter .....	5.00
" 12/07 B. W. Barrow for reporting meeting at Augusta....	25.00
" 14/07 Wolfe & Lombard for printing .....	3.00
Sep. 12/07 Postage and expressage paid by J. B. Wright, Secty..	3.00
Nov. 4/07 Expressage on package to J. B. Wright.....	.46
Jan. 4/08 Expressage on package to J. B. Wright .....	.65
Mch. 19/08 Augusta Chronicle .....	30.55
Jul. 31/08 Postage for 1 yr. paid by Treasurer .....	8.83
	<hr/>
	\$ 76.49
Balance on hand July 31st, 1908 .....	185.02
	<hr/>
	\$261.51

Cornelia, Ga., Aug. 12th, 1908.

We have examined the above account accompanied by a cash book and vouchers and find the papers are carefully kept, showing a balance in the Treasury of \$185.02, as above set forth.

For the care and accuracy with which the Treasurer has kept his accounts your committee wish to add their commendation.

NEIL MCINNES,

JNO. P. FORT.

Committee.

Upon motion, the report of the Committee on Auditing Treasurer's Report was adopted.

The PRESIDENT: We will now have the report of the Committee on Examination of Fruits.

## Report of Committee on Examination of Fruits

*Mr. President:*

Your committee on the Examination of Fruits on Exhibition beg leave to make the following report:

The fruit was examined and in the majority of cases found to be well grown, free from injury of fungi and insects, with the exception of a few specimens in one of the exhibits which had San Jose scale. There were 62 varieties of apples, eleven varieties of peaches, one of Japanese persimmons, one of quince, one of walnut, one of pecan and one of pear, on exhibition. Several of the apples were unknown and were too green to be identified; others were seedlings and as yet uncatalogued by the Pomological Society.

By far the most interesting exhibit was of Poor House apples, syn. Winter Queen. These apples were grown in different localities. One exhibit at Mayfield, Ga., elevation 500 feet, and the others were grown at Cornelia, Ga., elevation of 1700 feet. The Mayfield specimens, as a rule, were smaller than the Cornelia ones, and showed quite a difference in degree of ripeness, while those from the north and higher elevation were still quite green. This exhibit showed graphically the effect of location changing the size and general appearance.

Attached to this report will be found the list of fruit exhibited by individual members.

Respectfully submitted,

G. B. BRACKETT, Chairman.

T. A. MCHATTON,

GUY L. STEWART,

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## Exhibit of Fruits

EXHIBIT OF J. C. FREE, DEMOREST, GA.

*Apples.* Equinetelee (?), Horse, Buff (?), Smith's Cider, Kirbridge White (?), Bonum, Mother, Haas (?), Tolman Sweet, Jeffries, Black Detroit, Lawver, Delaware Red Winter, Salome, Summer Limber Twig (?), Pewaukee, Lady, Shockley, Ben Davis, Jesse, Baldwin, Maiden's Blush, Kimard, Fork Imperial, Grimes, Wells, (Seedling must be re-named) Betsy, Lilly (?), Wagner, Roman Stem, Mammoth Black Twig, Golden Pippin, Tallulah, Demorest, Mack, Ransom, five species unknown.

*Quince.* Orange.

EXHIBIT OF J. M. BOUTELE, DEMOREST, GA.

*Apples.* McIntosh, Terry, Gano, Rambo, Mammoth Black Twig, Ben Davis, Shockley, Lawver, Smith's Cider, Tolman Sweet, Lumsdens Best, one species unknown.

EXHIBIT OF D. H. HESKETT, DEMOREST, GA.

*Apples.* Nickajack, Rome, Beauty, Mammoth Black Twig, Kinnard, York Imperial, McAfee, Salome, Jeffries, Yates, Fall Pippin, McIntosh, Buncombe, one species unknown.

EXHIBIT OF BERCKMANS, MAYFIELD, GA.

*Apples.* Poor House syn. Winter Queen, Carter's Blue, Pine Stump, Equinetelee, Yates, Mrs. Bryan.

*Walnut.* Sieboldhana.

*Pecan.* Jerome.

*Persimmon.* Goshlo.

*Peaches.*—Tinsley's October, Atlanta, Billigens Late, Godier October, Darley.

EXHIBIT OF H. E. STAIGHT, DEMOREST, GA.

*Apples.* York Imperial, Nickajack, King of Tompkins County, Rhode Island Greening, Julian, Lawyer, Mother, Mammoth Black Twig, Yellow Belle Flower, Winesap, Ben Davis, Yates, Horse (?), Shockley, Terry.

EXHIBIT OF H. E. HAMLIN, BALDWIN, GA.

*Peach.* Susquehanna (?).

EXHIBIT OF J. C. RUDESILL, CORNELIA, GA.

*Peach.* Heath syn. White English.

EXHIBIT OF COL. FORT, MT. AIRY, GA.

*Pear.* LeConte.

*Peach.* Texas, Crawford's Late, Matthews, Beauty, Smock.

NEW NATIVE FRUITS.

Of native small fruits, Richmond County has produced a number of new seedling strawberries that are very promising. Among the number that have been well tested by the originator, we may mention the Flovella, a seedling of Bubach. The plant is large and stocky, foliage, a dark green and remarkably free from all rust and disease. Good root system; stands drought well; does well on either clay or sandy soil; prolific, large to very large and of the finest quality; good shipper; flowers are staminate.

The Augusta is another good berry. Plant healthy and vigorous and free from disease; fruit large to very large; of a dark red color to the center; fruit sweet and of a fine apple flavor. It is a staminate.

Another good berry is the Excellent. This is a seedling of the Crescent. The fruit is large, dark red to center, firm and solid, seeds prominent; a good shipper and a good table berry; flavor good. It is a pistillate variety; very prolific, and does its best on rich clay, loam soil. Your committee recommends these berries for further trial.

The report of the Committee was, upon vote had, declared adopted.

The PRESIDENT: The next business before the meeting is the election of officers for the following year.

Dr. Neil McInnes took the chair.

Col. FORT: There is but one man, Mr. Chairman, that this Society wishes as its president. I feel sure that I voice the unanimous sentiment of every member here when I say that we most earnestly desire our President, Mr. P. J. Berckmans, to remain in the position he has held so long and so faithfully, and I propose his name for re-election as President of this Society.

The motion was seconded by various members, and, a rising vote being taken, the Chair declared Mr. Beckmans to be unanimously re-elected to the office of President.

President Berckmans was recalled to the Chair, and said: "It embarrasses me very much to find words sufficient to thank you for this renewed evidence of your kind feelings to me. When we entered the field of horticulture in Georgia we had a difficult task; everything was new; our pomological resources were in an embryonic condition. We had nobody to assist us, and it was only through the greatest exertions, by correspondence and personal intercourse, that we finally succeeded in building up this Society. The Society enters now upon its thirty-third year. I regret that you have never been able to find anybody but myself to be at the head of it. I can not say anything but to thank you most sincerely for your confidence, and I will serve you to the best of my ability."

Prof. NEWMAN: The convention that organized this Society was called in the City of Atlanta in 1874. Atlanta had a strong pomological society there, and, as is characteristic of Atlanta people, they all stuck together. Over this man of international reputation, they elected a real estate agent as President, and he killed the thing dead by his conduct. When he was notified of his election, he deliberately drew a piece of paper from his pocket and read his acceptance. The society died a-borning right there. After waiting for two years to be sure that it was dead, I wrote to Mr. Berckmans and told him I thought we could now organize this society, and it was done.

The PRESIDENT: Our next business is the election of Vice-Presidents. The First Congressional District was not represented last year. We lost one of our most valuable members, and it was decided, by resolution of the Society, that the vacancy should be filled by the President. I was unable to find anyone in the District who would accept the office, and I appointed Mr. Hopkins, of Louisville. I wish he were with us today.

The same thing happened in the Eleventh Congressional District. We had nobody to represent us there, and I appointed Hon. Dudley M. Hughes as a successor to Col. Stubbs. So, the First and Eleventh Districts are filled by appointees.

A vacancy exists in the Second District on account of the death of Mr. Jones.

The following were nominated as Vice-Presidents of the Districts named, and were, upon vote, elected:

First Congressional District, Mr. David Brown.

Fifth Congressional District, Mr. Charles Deckner.

Seventh Congressional District, Mr. Geo. H. Miller, Rome, Ga.

Ninth Congressional District, Col. I. C. Wade, Cornelia, Ga.

Mr. Wight offered a motion, which was adopted, that the President be authorized to fill, by appointment, the vacancies in the First and Eleventh Congressional Districts.

For the position of Secretary, Mr. J. B. Wight was unanimously re-elected.

Mr. L. A. Berckmans was unanimously re-elected to the position of Treasurer.

Prof. Rogers, of Sparta, extended a cordial invitation to the Society to have its next meeting at Sparta. Prof. Akerman likewise urged that the Society meet next at Athens.

A ballot was taken, the result of which showed that Athens had received the majority of the votes, whereupon Prof. Rogers asked that the acceptance of the invitation from Athens be made unanimous, which was done.

Mr. Wight proposed the name of Col. G. B. Brackett, of Washington, D. C., as an honorary member of the Society, and he was unanimously elected. Col. Brackett assured the Society of his deep appreciation of this compliment, and of his willingness to render any assistance in his power to the Society or its members at any time and in any way that lay within his power.

#### QUESTION BOX.

Q. Does any one know the cause of Elberta peaches clinging to stone, and not breaking clean, like they used to when this variety was first introduced?

MEMBER: I don't think they are ripe.

Mr. L. A. BERCKMANS: I have heard several complaints in reference to that matter this year, and I think it is due to a lack of potash in the soil.

Q. Has anybody had any experience in pruning peach trees in summer-time after crop is off?

Col. WADE: I am doing it right now.

MEMBER: I have done so, and the result was very good. Some seemed to think the wood would decay, but it did not.

Q. We would like to have experience relating to cover crops in peach orchards in the mountain sections.

Col. FORT: I have used the cow-pea as a cover crop, and I think with good results. That is the only cover crop I have ever used. As we all suppose, it adds to the nitrogen in the soil. I would say the cover crop has been beneficial. I am using it in an apple orchard in the mountains at this time; I am using the same cover crop now, near Rabun Gap.

Mr. WIGHT: Two of our members have died since our last meeting, and, at the request of the President, I have prepared a brief memoir in regard to the death of those members, which I will now read.

Upon vote, Mr. Wight's resolution was adopted.

Mr. WIGHT: I move that a page in our proceedings be inscribed to the memory of Col. John M. Stubbs, and that the President request some one who knew Mr. Stubbs well to prepare a suitable memorial to his memory.

The PRESIDENT: I had requested Col. Dudley M. Hughes to do that, and he said he would do so.\*

Mr. Wight's motion was adopted by a standing vote.

Mr. WIGHT: Last year, we decided to meet during the second week in August, and that at this meeting we would decide where we would have our next meeting.

The PRESIDENT: Many of our members cannot attend these meetings in the summer-time, because they are busily engaged in shipping their fruit. Others are away on their vacation, and for these and other reasons our attendance is small. It was therefore suggested that we change the meeting time from August to February or some month in the winter. That question is now open for discussion and action. If there are no suggestions about the matter, we will let the question lay over until next year.

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\*The memorial on Col. Stubbs was prepared by Col. Hughes, of Danville, Ga., his life long friend.

**MEMBER:** I think we ought to change the time at least one week, anyhow, because the date as now fixed conflicts with the meeting of the State Agricultural Society. They are in session at Gainesville now, and that has prevented many of our members from attending this meeting.

**The PRESIDENT:** We have always met the first week in August in order not to conflict with the meeting of the Agricultural Society. Last June I corresponded with several of our leading members, requesting them to let me know their wishes in reference to the time this Society should meet. The majority of the answers I received was to the effect that, due to their large crops of fruit, it would be almost impossible for them to leave their business until well into August. When this date was selected, I never thought of the fact that we would conflict with the Agricultural Society. It was an error in fixing these dates for our meeting.

The report of the Committee on Resolutions was read and adopted, as follows:

Your Committee recommends the passage of the following resolutions:

1st. We wish to thank our honored President for continuing to give us his valuable services. We feel that the Society has been exceedingly fortunate in benefiting by his thirty-two years of continuous service.

2nd: The hearty thanks of this body are due to the Chamber of Commerce, the municipal authorities, the Fruit Growers' Association of Yonah Land and the citizens of Cornelia and vicinity for their cordial welcome and the many courtesies extended to us.

3rd: This Society wishes to extend its congratulations to the fruit growers of this region on the signs of thrift and prosperity that are so evident on every hand and on the uniformly excellent condition of the various orchard properties visited.

4th: We wish to extend our thanks to the Legislature for its recognition of the needs of the Horticultural interests of the State in increasing the salary of the State Entomologist.

5th. We wish to call the attention of those charged with the management of the new Agricultural Schools to the importance of giving due prominence to the teaching of Horticultural subjects.

6th: This Society strongly advises its members to give earnest thought to the subject of effecting some efficient co-operative organization before another shipping season, for the purposes of securing greater uniformity in grading and packing, better packages, improved transportation facilities, better utilization of waste products, and above all a wider and more uniform distribution of shipments. We believe these objects may be best obtained by the formation of strong local associations which shall unite in the formation of a central shippers' union, which shall have absolute control over the distribution of shipments.

Respectfully submitted,

J. N. ROGERS,

H. L. LONG,

F. S. EARLE.

Col. WADE: I wish to offer the following resolution:

*Resolved*, That the peach growers shall respond to the request of the Editor of the *Atlanta Constitution*, in the matter of uniting to create a better method of marketing the fruit.

MEMBER: As a substitute to that, I move that the Chair appoint five members of this Society to represent us at the meeting of the peach growers to be held in Atlanta some time in September, to discuss the matter of the better marketing of the peach crop of Georgia, the Chairman to appoint the Committee at his leisure.

Committee to represent the Horticultural Society at the meeting of the Peach Growers' Association at Atlanta, September 10th, 1908.

T. R. LOMBARD, Cornelia.

J. C. MILLER, Rome.

C. W. WITHOFT, Ft. Valley.

H. L. LONG, Leesburg.

H. K. WHITE, Sparta.

This substitute was, upon vote, declared adopted.

Col. WADE: Now that our business is all finished, I wish to extend, not only to all members of our Society who are present, and our special guests, but also to every one who has taken sufficient interest in our meetings to walk from the town over to this building this morning to listen to our proceedings, a

most cordial invitation to partake of the barbecue which is now awaiting us nearby.

The meeting was declared adjourned, and those present proceeded to a nearby grove where they enjoyed a most delightful barbecue furnished by the charming citizens of Cornelia.

NOTE.—Reports of the vice-presidents were made at the annual meeting but it was thought advisable to omit them from this report and publish instead the fruit lists which have not been printed for past two years.

## **Mitchell B. Jones**

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In the death of Mr. Mitchell B. Jones, Vice-President of our Society for the Second District, which occurred at his home near Thomasville, Ga., on January 24, 1908, the Georgia State Horticultural Society has lost one of its best and most active members. Mr. Jones was a fine example of the best class of Southern gentlemen. True, honorable and upright in all his dealings, he will be missed at our annual meetings, where his genial manners and gentlemanly bearing have made for him friends of all whom he has met. His home was the center of such delightful and warm-hearted hospitality as is rarely known in these commercial days.

The Georgia State Horticultural Society honors him, not only for his true worth as a man, but for the interest he has taken in helping to make it what it should be; and it is hereby ordered that a page in our proceedings be inscribed to his memory.

## John Madison Stubbs

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Was born in Bibb County, Georgia, in 1839, and died in Dublin, September 16, 1907. He chose law as his profession. He was a man of exquisite taste, indefatigable energy and was foremost in upbuilding the town of Dublin, where he made his permanent home early in the seventies, and from a struggling village his best efforts were given to make it one of the most important cities of Georgia. He gave much of his time to development of industrial enterprises, establishing river steamer navigation and railroads, but horticulture was his fondest pastime. His home grounds were the most beautiful in his section; his fruit orchard the pride of his life, and when, in 1876, he saw that commercial fruit growing was perhaps one of the best means to build up the many latent possibilities of our State, he was among the first to advocate establishing a school of horticulture where our farmers' boys could be educated in the higher branches of scientific agriculture. Through his efforts the Georgia State Horticultural Society was organized at Macon on August 16th, 17th and 18th, 1876. He was a most active worker and held the position of Vice-President for his Congressional District until his death. He served his State as a Confederate soldier during the entire war and was brevetted Lieutenant-Colonel for bravery. His home life was ideal; a princely entertainer and loyal to those he liked; a public-spirited and generous citizen. Thus passed away one of the most conspicuous men of Georgia, who left his mark such as time alone can destroy. To his memory his friends and co-workers in the cause of humanitarian progress affectionately dedicate this page as a tribute to one of their faithful associates.

# CATALOGUE OF FRUITS

## PLAN OF CATALOGUE.

To enable the Society to publish a full and reliable catalogue of fruits which are successfully cultivated in Georgia, and in view of the vast differences which the climatic influence of the several sections of our State has upon the same fruit cultivated upon the mountains or near the seacoast, it has been deemed advisable to divide the State into four distinct sections.

1. The *Upper or Mountainous Region*, comprising the counties of Banks, Bartow, Catoosa, Chattooga, Cherokee, Cobb, Dade, Dawson, Fannin, Floyd, Forsyth, Franklin, Gilmer, Gordon, Habersham, Hall, Haralson, Lumpkin, Milton, Murray, Paulding, Pickens, Polk, Rabun, Stephens, Towns, Union, Walker, White and Whitfield.

2. The *Middle Region*, Comprising all of the counties of the State not included by name in the other three regions.

3. The *Southern Region*, Comprising the counties of Appling, Baker, Ben Hill, Berrien, Brooks, Calhoun, Charlton, Clinch, Coffee, Colquitt, Crisp, Decatur, Dougherty, Early, Echols, Grady, Irwin, Jeff Davis, Lowndes, Miller, Mitchell, Pierce, Tift, Thomas, Turner, Ware, Wayne and Worth.

4. The *Lower or Coast Region*, comprising the counties of Chatham, Bryan, Liberty, McIntosh, Glynn and Camden.

The explanations of the columns will be found under each class of fruits.

The varieties named in the several lists are recognized good quality, inferior or rejected varieties being omitted.

Synonyms are given in a few instances only where it was deemed necessary; these are placed after the adopted name.

One "\*" indicates that the varieties succeeded well in the region named at the head of column. Two "\*\*\*" indicate the varieties most highly recommended. No "" indicates no report, or that the variety is not sufficiently tested. A dash "—" indicates that the variety is unsuited.

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## APPLES.

### EXPLANATION OF COLUMNS—

Column 1—Name of varieties.

Column 2—Season of maturity.

Column 3—The particular use for which it is best adapted.

Columns 4, 5, 6 and 7—The regions for which the varieties are recommended.

Column 8—Remarks.

# EXPLANATION OF ABBREVIATIONS—

Column 2—*Seasons*—S, summer; A, autumn; W, winter; E, early; L, late; E. S., early summer; L. W., late winter, etc.

Column 3—*Use*—K, designates varieties recommended only for the kitchen or cooking purposes; D, for drying; C, for those specially intended for cider; M, those most valued for market. Varieties not marked may be considered as table or dessert sorts.

## APPLES—Continued.

NAME	Season.	Use.	Rating.				REMARKS.
			Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Astrachan Red	ES	M	**	**	*	*	Profitable early market; very prolific.
Ben Davis, <i>syn.</i> , <i>New York Pippin</i>	LW	M	**	*	...	...	Second quality, excellent keeper.
Black Warrior	LW	M	**	*	*	*	Excellent; fine keeper; prolific.
Bonum	A	M	*	*	*	*	An excellent late fall apple.
Buncombe, <i>syn.</i> , <i>Meigs' Red Winter Pearmain</i>	A	M	*	**	...	...	Excellent; in some soils liable to blight of bloom buds.
Carolina Greening, <i>syn.</i> , <i>Green Crank</i> , <i>Southern Greening</i> , <i>Green Cheese</i>	W	M	**	**	...	...	Excellent.
Carolina Watson	S	M	*	*	...	...	Very large; prolific; profitable market.
Carter Blue, <i>syn.</i> , <i>Lady Fitzpatrick</i>	A	M	*	*	*	*	Large, sugary, very fine; splendid grower
Chattahoochee	W	M	*	**	...	...	Excellent and fine keeper.
Cullasaga	EW	M	*	*	...	...	Requires strong clay soil.
Disharoom	A	M	*	*	...	...	Good quality; fine grower.
Early Harvest	ES	M	*	*	*	*	Universal favorite.
Elgin Pippin	A	M	*	*	...	...	Large and very good.
Equinetelee, <i>syn.</i> , <i>Bachelor</i> , <i>Buckingham</i>	A	M	**	**	*	*	Very good; needs strong soil.
Etowah, <i>syn.</i> , <i>Cooper Red</i>	W	M	**	**	*	*	Very good; fine keeper.
Fall Pippin	A	M	**	*	...	...	Large and very good. [prolific
Family	S	M	*	*	*	*	Excellent and profitable summer apple;
Floyd	S	M	*	*	...	...	Ripens from June to September.
Gravenstein	ES	K	**	*	*	*	Productive; a valuable summer variety
Grimes' Golden	EW	M	**	*	...	...	Very good in Mountain Region.
Heslep	W	R	*	*	...	...	An imp'd. Shockley and of better quality
Hiley Eureka	LW	M	**	*	...	...	Late keeper.
Hocket's Sweet	LW	M	**	*	...	...	Prolific and good keeper.
Hominy, <i>syn.</i> , <i>Summer Queen of Kentucky</i> , <i>Sops of Wine</i>	S	M	**	**	*	*	Excellent; prolific.
Horn	LW	M	**	*	...	...	Good keeper; open grower. [lasts 2 mo.
Horse	S	K	**	**	*	*	Superior for cooking and drying; prolific
Jewett Best	S	M	*	*	...	...	Very large; very good; stout grower.
Julian	S	C	**	*	...	...	Productive; excellent for cider; showy fruit.
Kentucky Red Streak, <i>syn.</i> , <i>Bradford Best</i>	A	M	*	*	...	...	Fine grower.
Kinnard	W	M	**	*	...	...	Excellent for Mountain Region.
Lanier	A	M	*	*	...	...	Showy fall apple; good quality.
Mamma	A	M	*	*	...	...	Very good; fine tree.
Mangum	W	M	**	*	...	...	Excellent; prolific.
Maverick Sweet	W	M	*	*	...	...	Very good; good keeper. [tain Region
May Pippin	ES	M	*	*	...	...	Very early; reliable in Middle and Moun-
Mitchell Cider	S	C	**	*	...	...	Promising well; late summer.
Moultrie, <i>syn.</i> , <i>Indian Winter</i>	LW	M	**	*	...	...	Good and late keeper.

NAME	Season.	Use.	Rating.				REMARKS.
			Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Mrs. Bryan	A	M	**	*	*	*	Showy and excellent; valuable for market.
Nickjack, <i>syn.</i> , <i>Summer</i> <i>our</i> , <i>Berry</i> , <i>Wonder</i> .....	W	M	*	*	*	*	Excellent in some sections of Middle Region; unreliable; apt to drop before attaining full size.
Oconee Greening.....	A	K	*	*	*	*	Excellent.
Oxal-va	ES	*	*	*	*	*	Showy and prolific; from Hungary
Palmer, <i>syn.</i> , <i>Pear</i> .....	A	M	*	*	*	*	Medium; very good; prolific.
Pineclump.....	A	M	*	*	*	*	Promising for Piedmont area.
Poor House, <i>syn.</i> , <i>Winter</i> <i>Queen</i> , <i>Winter Gem</i> .....	W	M	**	**	*	*	Productive, good keeper; profitable market.
Red Beltigheimer.....	A	*	*	*	*	*	Promising well. [ket sort
Red June, <i>syn.</i> , <i>Carolina</i> <i>Red June</i> .....	ES	M	**	**	*	*	Early, prolific, very good; bears very young; profitable for market.
Rhodes Orange.....	ES	*	*	*	*	*	Excellent summer fruit.
Rome Beauty.....	A	M	**	*	*	*	Showy and excellent.
Romanite.....	LW	M	**	*	*	*	Good quality; excellent in Mt. Region.
Rough and Ready.....	W	M	*	*	*	*	Profitable in Northwest Georgia.
Sauta.....	LW	M	*	*	*	*	Very good; late keeper, even on coast.
Shockley.....	LW	M	**	*	*	*	Reliable in every section; profitable.
Simmons Red.....	S	*	*	*	*	*	* Matures from June to October.
Stevenson Winter.....	LW	M	**	*	*	*	Unsurpassed in quality, bearing and keeping.
Striped June, <i>syn.</i> , <i>Early</i> <i>Red Margaret of the</i> <i>South</i> .....	ES	M	**	**	*	*	* Excellent; fine grower, and prolific [ing
Summer Cheese.....	S	K	*	*	*	*	* Large, prolific, excellent for cooking, dry-
Summer Queen.....	S	M	*	*	*	*	* Good market apple.
Sweet Bough, <i>syn.</i> , <i>Sweet</i> <i>Harvest</i> .....	S	M	**	*	*	*	* Very good; early; sweet. [ket open grower
Taunton.....	A	*	*	*	*	*	* Large, showy; good quality; fine for mar-
Terry.....	LW	M	*	*	*	*	* An excellent keeper; good quality; pro-
Tetofski.....	ES	*	*	*	*	*	* Promising; tree very dwarf. [fitable
Wallace Howard.....	A	M	*	*	*	*	* Very showy; excellent.
White Winter Pear- <i>main</i> .....	W	*	*	*	*	*	* Good.
Winesap.....	LW	M	*	*	*	*	* Quality very good.
Yates.....	LW	*	*	*	*	*	* Very good quality; small.
Yellow Transparent.....	ES	*	*	*	*	*	* Showy and early. [able
Yopp Favorite.....	S	K	*	*	*	*	* Very good; prolific; bears young; desir-

### CRAB APPLES.

NAME	Season.	Use.	Rating.				REMARKS.
			Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Red Siberian.....	LS	C	*	*	*	*	
Transcendant.....	LS	C	*	*	*	*	
Yellow Siberian.....	LS	C	*	*	*	*	

# APPLES—Continued.

## LEADING VARIETIES OF APPLES FOR MARKET ORCHARDS.

*Summer*—Astrachan, Early Harvest, Gravenstein, Hominy, Horse, Kansas Queen, Red June, Striped June.

*Autumn*—Buncombe, Equinetelee, Fall Pippin, Hargrove, Mrs. Bryan.

*Winter*—Black Warrior, Ben Davis, Chattahoochee, Etowah, Grimes Golden, Hockett Sweet, Mangum, Romanite Rough and Ready, Sauta, Shockley, Stevenson, Terry, Yates, Wade, Wallace Howard, Winesap, Rome Beauty.

## PEACHES.

**EXPLANATION OF COLUMNS.**—1st, name of variety; 2nd, class—freestone or clingstone; 3d color of flesh; 4th, season; 5th, use. Remaining columns denote the region, etc.

**ABBREVIATIONS.**—Class—F, freestone; C, Clingstone; S. C., semi-cling. Flesh—W, white; Y, yellow; R, red. Season—E, early; VE, very early; M, medium; L, late; VL, very late. Very early, ripens from end of May to June 20th; early, from August 10th to October 1st; very late, from October 1st to November 10th. Use—F, for family use only; M, the most valuable for market; D, the most desirable for drying.

NAME	Class.	Color of Flesh.	Season.	Use.	Rating.			REMARKS.
					Mountain Region.	Middle Region.	Southern Region.	
Alexander, <i>syn.</i> , <i>Amsden</i> .....	SC	W	VE	M	*	*	*	Quality good for its season; bri't color; still profitable in some sections.
Amelia, <i>syn.</i> , <i>Stroman Carolina</i> .....	F	W	E	F	*	*	*	Very large; very good
Arkansas Mammoth .....	F	W	L	F	*	*	*	Large late cling of good quality.
Baldwin Late .....	F	W	VL	F	*	*	*	Good late freestone.
Belle .....	F	W	M	M	*	*	*	Of Chinense type; earlier than Elberta, excellent market sort.
Berence .....	F	Y	L	MF	*	*	*	Large, showy, excellent.
Bustian October .....	F	W	VL	M	*	*	*	An excellent very late cling.
Carman .....	CF	W	VE	M	*	*	*	Superior to Waddell.
Champion .....	CF	W	M	MF	*	*	*	Of excellent quality.
Chinese Cling .....	CF	W	M	F	*	*	*	Excellent and large; subject to rot.
Chinese Free .....	F	W	M	M	*	*	*	Somewhat earlier than Thurber.
Columbia, <i>syn.</i> , <i>Indian, Pae</i> .....	F	Y	M	MD	*	*	*	Excellent for all purposes.
Cora .....	F	W	VL	F	*	*	*	Superior to Baldwin.
Cornelia .....	F	W	M	MF	*	*	*	Precedes Belle; promising.
Crawford Early .....	F	Y	E	F	*	*	*	Good but small.
Crawford Late .....	F	Y	M	F	*	*	*	Variable; rots in some seasons.
Demming Sept'ber. ....	C	Y	L	F	*	*	*	Similar to Lemon Cling; ripens one month later.
Early Tillotson .....	F	W	E	M	**	**	*	Very good; inferior to Hiley.
Eaton Golden .....	C	Y	L	D	*	*	*	Superior Cling for preserving.

# PEACHES—Continued.

NAME	Class.	Color of Flesh.	Season.	Use.	Rating.				REMARKS.
					Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Elberta.....	F	Y	M	M	++	++	++	++	Very large and handsome; standard market variety. [sections
Emma.....	F	Y	M	M	+	+	+	+	Follows Elberta; profitable in some
Everbearing.....	F	W	E	M	+	+	+	+	Unique; good for family use.
Ford.....	F	W	E	M	+	+	+	+	Large; early promising.
Foster.....	F	Y	E	F	+	+	+	+	Earlier than E. Crawford.
Fox.....	F	W	L	M	+	+	+	+	Good late market.
Frances.....	F	Y	M	F	+	+	+	+	Very large and handsome.
General Lee, <i>syn.</i> , R. E. Lee.....	C	W	M	M	++	++	++	++	More reliable than its parent, Chinese [Cling
General Taylor.....	C	R	E	F	+	+	+	+	Very good early cling.
Goode October.....	C	R	V	L	F	+	+	+	Very good late Indian cling.
Greensboro.....	F	W	V	E	M	+	+	+	Quality very good; profitable market sort in Middle Region.
Heath White, <i>syn.</i> , White English.....	C	W	L	M	++	++	++	++	Excellent for preserving and home market.
Hiley, <i>syn.</i> , Early Belle.....	F	W	E	M	++	++	++	++	Improvement on Tillotson; fine market sort.
Indian Blood.....	C	R	M	F	+	+	+	+	Very juicy and good.
Juno.....	C	Y	L	F	+	+	+	+	Excellent quality; three weeks later than Oriole.
Kennesaw, <i>syn.</i> , Dr. Hogg.....	F	W	V	E	+	+	+	+	Follows Carman; promising.
Lady Ingold.....	F	Y	M	M	+	+	+	+	Excellent; earlier than E. Crawford
Lemon Cling, <i>syn.</i> , Pineapples.....	C	Y	M	F	++	++	++	++	Superior cling for preserving.
Mamie Koss.....	F	W	E	M	+	+	+	+	Promising market variety.
Miss Lola.....	F	W	E	F	+	+	+	+	Promising.
Mountain Rose.....	F	W	M	M	+	+	+	+	Excellent quality.
Newington Cling.....	C	W	M	F	+	+	+	+	Superior to Oldmixon cling.
Oldmixon Free.....	C	W	M	F	+	+	+	+	Good family variety.
Oldmixon Cling.....	C	W	M	F	+	+	+	+	Good family variety.
Oriole.....	C	Y	M	F	++	++	++	++	One of the best yellow July cling.
Osecola.....	F	Y	L	F	+	+	+	+	Good freestone of Indian type.
Picquet Late.....	F	Y	L	FD	++	++	++	++	Best freestone of its season.
Plant.....	C	Y	M	F	+	+	+	+	Large, showy; August.
Red River.....	F	W	V	E	F	+	+	+	Good family variety.
Rivers.....	SC	W	V	E	F	+	++	++	Excellent quality; medium size; too tender for market.
Salway.....	F	Y	L	M	+	+	+	+	Follows Elberta as a shipper.
Slappey.....	F	Y	M	M	+	+	+	+	Promising for market.
Sneed.....	CS	W	V	E	M	+	+	+	A very early shipper; poor quality.
Stinson October.....	C	W	V	L	M	+	++	++	Best very late market variety.
St. John, <i>syn.</i> , May Beauty.....	F	Y	E	F	+	++	+	+	Very good, early, but small.
Stump the World.....	F	W	M	M	++	++	++	++	Not as valuable as formerly.
Summerour, <i>syn.</i> , Atlanta.....	F	Y	L	M	++	++	++	++	Late market.
Susquehanna.....	F	Y	M	F	+	+	+	+	Large; superior to L. Crawford.
Texas.....	F	W	L	+	+	+	+	+	Late freestone; promising.
Thurber.....	F	W	M	M	+	++	++	++	Large; excellent quality; profitable.
Tinsley October.....	C	Y	V	L	F	+	+	+	Good late cling.
Tuskens.....	C	Y	E	F	+	+	+	+	Similar to Lemon Cling; June. [Ising
Victor.....	SC	W	V	E	M	+	+	+	Earliest of all; good quality very prom
Waddell.....	F	W	V	E	M	+	++	++	Early and profitable; matures with Carman

# LEADING VARIETIES IN ORDER OF MATURITY FOR FAMILY USE OR HOME MARKET

Victor, Sneed, Alexander, Greensboro, Red River, Carman, Waddell, Kennesaw, Mamie Ross, Miss Lola, St. John, Hiley, Lady Ingold, Mountain Rose, Champion, E. Crawford, General Lee, Chinese Free, Thurber, Elberta, Berenice, Oriole, Columbia, Lemon, Salway, Picquet, White Heath, Eaton Golden, Cora, Texas, Summerour, Stinson.

# LEADING VARIETIES FOR SHIPMENT TO NORTHERN AND WESTERN MARKETS.

Greensboro, Carman, Waddell, Mamie Ross, Hiley, Belle, Chinese Free, Thurber, Elberta, Salway.

## NECTARINES.

Boston, Coosa, Downton, Early, Newington, Early Scarlet, Early Violet, Elruge, Golden Cling, Hardewick, Hunt Tawny, New White, Red Roman, Stanwix, Victoria.

Reports from every section state this fruit to be unreliable owing to attacks of the Curculio, and, unless carefully sprayed, is unproductive.

## APRICOTS.

Explanations and abbreviations same as Peaches.

NAME	Class.	Color of Flesh.	Season.	Use.	Rating.				REMARKS
					Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Breda.....	F	Y	E	.....	*	*	.....	.....	Trees in orchards are liable to be killed by spring frost. Only desirable for city gardens or where protected by surrounding buildings.
Early Golden.....	F	Y	E	.....	*	*	.....	.....	
Hemskirke.....	F	Y	M	.....	*	*	.....	.....	
Kaisha.....	F	Y	M	.....	*	*	.....	.....	
Large Early.....	F	Y	E	.....	*	*	.....	.....	
Large Red.....	F	Y	M	.....	*	*	.....	.....	
Moorpark.....	F	Y	L	.....	*	*	.....	.....	
Orange.....	C	Y	M	.....	*	*	.....	.....	
Peach.....	F	Y	M	.....	*	*	.....	.....	
Royal.....	F	Y	M	.....	*	*	.....	.....	
St. Ambrose.....	F	Y	M	.....	*	*	.....	.....	
Turkey.....	F	Y	L	.....	*	*	.....	.....	

## POMEGRANATES.

The Climate of Mountain Region is too Cold to Grow This Plant.

NAME	Rating.				REMARKS.
	Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Acid.....	..	..	..	..	Suitable for Middle and Southern Region.
Large Sweet.....	..	..	..	..	
Spanish Ruby. <i>syn.</i> .....	..	..	..	..	
Purple seeded.....	..	..	..	..	

## NUTS.

### WALNUTS.

**ENGLISH:**—*Juglans regia*—The most suitable soils are calcareous clay, loam, gravelly or stony, naturally well drained; stiff clays retentive of humidity, are unsuited.

**COMMON**—This is the typical variety, from which are derived the following forms or sub-varieties.

*Chaberte*—Nut oval, medium, full kernel, rich in oil, blooms late.

*Early Bearing* (*Præpariuriens*)—Nuts medium, nearly round, good quality. The tree is remarkably prolific and begins to yield fruit at from four to five years from seed. Half hard shell.

*Franquette*—Large, oblong, pointed, full kernel, half hard shell.

*Mayette*—Nuts produced in pairs, half hard shell, full kernel, excellent quality.

*Paristenne*—Large, oblong, half hard and rough shell, kernel scarcely filling the shell. Very prolific and of good quality.

*St. John*—Nuts medium, hard shell, good quality. Blooms latest of all, and valuable where late spring prevails.

*Thin Shelled*—Nuts large, oblong, very thin shell, of excellent quality and the standard dessert variety. Keeps sweet a long time. Its shell is likely to be crushed when roughly handled.

*Barthere*—Nut very long, half hard shell, full kernel.

*Atlantus Leaved*—Fruit produced in pendulous clusters, wholly of ornamental value.

*Cut Leaved*—Leaves deeply laciniated. Nuts medium, of good quality.

*Long Beaked*—Fruit with a long beak. Of no special commercial value.

**WALNUT JAPAN:** (1) *Juglans siboldiana*—A native of the mountains of Japan; extremely hardy and vigorous grower, with beautiful and symmetrical form. Nuts have been produced at three years of age. Wonderfully productive. On older trees the clusters consist of from 6 to 20 nuts. Shell thicker than that of the English Walnut. Meat sweet and of good quality.

(2) *Juglans Cordiformis*—Differs from the preceding variety in the form of nut, which is broad pointed and flattened; of medium size, with thinner shell than Sieboldiana, and if cracked longitudinally the kernel may be removed entire. Meat of good quality. Tree very vigorous grower; attains great height with magnificent head. Probably the best of the cultivated walnuts for this section.

**WALNUT, AMERICAN BLACK—**(*Juglans nigra*)—Fruit large, very hard shell, kernel sweet. Doubtless susceptible of producing improved varieties by judicious selection. Timber value for cabinet work.

**WALNUT, ASHY GREY OR BUTTER NUT—**(*Juglans cinerea*)—Mountain districts, nut large, hard shell. May be improved under cultivation. The timber is valuable for cabinet work.

#### PECANS.

(*Carya olivaeformis*.)

Pecans succeed in almost any soil, but best in rich alluvial or river bottoms. Hardy from Texas to Nebraska. Nuts vary in size and shape, from the very hard shell nuts to the very thin paper shell, which sometimes attain two and a half inches in length. Forms reproduce themselves from seed with some variation, the average of self-production being less than fifty per cent.

The Paper Shell command the highest market prices. In shape they vary from two and a half inches long by three-quarters to one inch in diameter to other shapes approaching to the more globular, but the distinctive characteristic is the more or less thin shell, which is well filled by a sweet and well flavored kernel. Many forms of the paper shell class are now propagated and sold under recognized names, the best known of which follow in tabulated form:

**EXPLANATION OF COLUMNS AND ABBREVIATIONS**—1st, name of variety; 2d, origin; 3d, size—M, medium; L, large; VL, very large; 4th, shape—O, ovoid or plump; L, oblong; P, pointed; 5th, quality—G, good; VG, very good; B, best.

**RATING**—Same as for other fruit. All of the varieties have been tentatively single starred for the Southern and Coast Regions, and a few standards for the Middle Region.

NAME	Origin.	Size.	Shape.	Quality.	Rating.			REMARKS
					Mountain Region.	Middle Region.	Southern Region.	
Atlanta	Ga	M	LP	VG	..	..	*	Large kernels; excellent quality
Bacon	Ga	M	O	B	..	..	*	Heavy bearer; quality best.
Bolton	Fla	L	O	G	..	..	*	An old standard.
Bradley	Fla	L	L	B	..	..	*	Large and of excellent quality.
Carman	La	VL	LP	G	..	..	*	Largest of all; handsome.
Centennial	La	VL	LP	G	..	..	*	Very large and fine.
Columbian, <i>syn.</i> , <i>Rome, Mammoth,</i> <i>Pride of the Coast</i>	La	VL	LP	VG	..	..	*	Very large and fine one of the best for certain sections.
Curtiss	Fla	M	OP	B	..	**	*	Of Excellent quality.
Frotscher	La	L	O	VG	..	**	*	Standard; very thin shell; reliable
Georgia Giant	Ga	VL	O	G	..	..	*	Very large and plump.
Hume	Fla	M	O	VG	..	..	*	Very thin shell; fine quality.
Jerome	La	VL	O	VG	**	..	..	Superior to Columbian of which it is a seedling; very prolific.
Jumbo	Tex	L	OP	VG	..	..	*	Handsome and fine quality.
Louisiana	Tex	L	LP	VG	..	..	*	Full meated; fine quality.
Magnum Bonum	Ga	M	OP	VG	..	..	*	Plump kernel; fine quality.
Money-maker	La	L	O	G	..	..	*	Large and handsome.
Randall	Fla	M	O	VG	..	..	*	Kernel plump; separates readily
Russell	Miss.	M	OP	G	..	..	*	Abundant bearer.
Shiley	Miss.	M	OP	VG	..	..	*	Very early bearer; prolific.
Senator	Ga	M	OP	B	..	..	*	One of the best in quality.
Stevens	Ga	M	OP	G	..	..	*	Prolific.
Stuart	Miss.	L	O	VG	**	**	*	Standard; ovoid; plump kernel.
Van Deman	La	L	LP	G	**	**	*	Standard; long fine nut; variable in size.

Hard-Shell Pecans vary in size and shape of nuts, the larger forms being two inches by three-quarters, and many are of excellent quality, but as a commercial commodity do not command the high prices of the former.

**Note**—The impression prevails that whenever the tap root is cut in transplanting the tree never bears fruit. This is a ridiculous assertion, and is misleading, as it is contrary to all past experience, because of the fact that most of the thousands of bearing Pecan trees found throughout the State had their tap root sometime reduced to a few inches in length.

#### CHESTNUTS.

*American* (*Castanea Americana*). Nuts of medium size, usually three in a burr, the middle one flattened and sometimes imperfect, the outer ones plano-convex; flavor sweet, succeeds in almost any soil not too moist, but thrives best in rich, clayey or rocky soils in the upland districts. Many forms have been produced by careful selection of the largest nuts.

*Chincapin* (*Castanea pumila*)—Nuts small, solitary in burr, flavor sweet. A small tree or large shrub, succeeding in much lower sections of the State than the chestnut. An improved form is disseminated under the name of "Rush Hybrid."

*European* (*Castanea vesca*)—In each country in Europe are found forms which seem specially adapted thereto, and known mainly under local names. The following may be classed as principal varieties and known as commercial sorts:

Ordinary—Nuts medium, very productive, usually propagated from seed and the varieties known as European or Spanish.

Exalade—Nuts large and considered of the best quality: tree rather dwarf and productive.

Pourtalonne—Nuts very large.

Green of Limousin—Large, and keeps sweet and a long time.

Combale—Nut very large and trees very productive.

Nourzillarde—Very large, and requires a warm soil and section.

Lyons, Luc, Lusignan, d'Agen, etc., are names given to the large nuts usually found in commerce.

Identical reproduction by seed is unreliable; fifty per cent. may be taken as a fair average. The best varieties are increased by grafting.

*Japan*—This is a distinct type, resembling the European more closely than the American, and contains many forms. Nuts grown upon seedling trees vary remarkably in size, some being scarcely as large as the American sweet chestnut, whereas others are larger than any of the European sorts. Hence the best forms can only be reliably propagated by grafting. The word Mammoth can not always be applied to seedlings, because of the great variation in size.

The true Mammoth as produced upon grafted trees, is of very large size, sometimes attaining one and three-quarters by one and one-half inches. Flavor sweet but inferior to the European sorts. Burrs often producing four to five nuts, and occasionally as many as seven. Trees are very dwarf growth, and begin to bear fruit at two years from graft, but seem to be short lived.

The following tabulated list includes the varieties of the EUROPEAN (or Spanish) and JAPANESE types most commonly disseminated:

EXPLANATION OF COLUMNS AND ABBREVIATIONS—1st, name, variety; 2d, size of burr—S, small; M, medium; L, large; VL, very large; ML, medium to large; 3d, size of nut—abbreviations same as for burr; 4th, maturity.

RATING has been omitted with this nut, although nearly every variety will succeed in the Mountain Region, many in the Middle Region, and a few in the Southern Region.

NAME	Size of Burr.	Size of Nuts.	Maturity.	Rating.				REMARKS.
				Northern Region.	Middle Region.	Southern Region.	Coast Region.	
<i>European Type.</i>								
Scott.....	M	M	L	.....	.....	.....	.....	Standard early variety. Standard; midseason; productive. Standard late variety.
Hannum, <i>syn.</i> , <i>Scyer</i> .....	M	M	M	.....	.....	.....	.....	
Numbo.....	M	L	E	.....	.....	.....	.....	
Paragon.....	VL	L	M	.....	.....	.....	.....	
Ridgeley.....	ML	ML	L	.....	.....	.....	.....	
<i>Japanese Type.</i>								
Advance .....	M	VL	VE	.....	.....	.....	.....	Earliest of all; very large.
Biddle.....	M	L	L	.....	.....	.....	.....	
Black.....	L	L	E	.....	.....	.....	.....	Of excellent quality. Early bearer. Very prolific; of good quality. Reputed as best of the Japanese type Tree vigorous; quality of nut inferior Large, very early; fine quality. Standard; very large and fine. Precocious and heavy bearer.
Coe.....	L	VL	L	.....	.....	.....	.....	
Kent.....	S	ML	E	.....	.....	.....	.....	
Kerr.....	S	ML	M	.....	.....	.....	.....	
Killen.....	VL	VL	L	.....	.....	.....	.....	
Martin.....	L	VL	L	.....	.....	.....	.....	
McFarland.....	VL	L	VE	.....	.....	.....	.....	
Parry.....	VL	VL	L	.....	.....	.....	.....	
Reliance.....	M	ML	L	.....	.....	.....	.....	

#### ALMONDS.

As a rule unsuited to the State of Georgia owing to fruit blooms being injured by spring frosts. Occasionally successful in the Coast and Southern regions.

*Hard-Shell*—This section comprises several varieties with sweet and bitter kernels. The latter resist spring frosts better than the sweet varieties, and often yield good crops of nuts, which are, however, of little value for culinary purposes. Where successful, the following sub-varieties produce sweet nuts: *Ordinary, Large Green, Half Hard Shell*. all sweet nuts; *Matherone, Moliere, Pistache*.

*Soft or Paper Shell, Princess, Sultana, Heterophyll*—This is the most esteemed for using in a fresh state. Peach Almond, a variety with occasionally a fleshy hull, in this resembling a peach. Of little value as a fruit.

#### FILBERTS.

(*Corylus avellana*.)

These are divided into two classes: 1. Filberts, or with long husks. 2. Hazelnuts, or with short husks. These plants thrive best in light but rich soils, and not too dry. Plants must be trained to single stems and very low heads, all suckers carefully removed. The best varieties are *Cosford, Kentish Cob, Lombard, Purple Filbert, White Filbert*.

# PEARS.

EXPLANATION OF COLUMNS—1st, name of variety; 2d, season; 3d, use; 4th, stock upon which the variety succeeds best; remainder, the region in which the varieties are recommended.

ABBREVIATIONS—Season and Use, same as those for Apples. Stock—Q, (dwarf) quince; S, (standard) pear stock. Where not marked, the varieties thrive equally upon quince or pear.

NAME	Season.	Use.	Stock.	Rating.				REMARKS
				Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Bartlett.....	S	M	S	**	**	**	**	Good everywhere, but subject to blight
Belle Lucrative.....	S	M	S	**	**	**	**	Good for family use.
Beurre Clairgeau.....	A	M	Q	**	**	**	**	Apt to lose its foliage.
Beurre d'Anjou.....	S	M	Q	**	**	**	**	Very good.
Beurre Diel.....	S	M	Q	**	**	**	**	Good.
Beurre Easter.....	W	M	Q	**	**	**	**	A late keeper.
Beurre Giffard.....	ES	M	Q	**	**	**	**	Very early; open growth.
Beurre Langelier.....	A	M	Q	**	**	**	**	Very fine in Mountain Region.
Beurre Superfin.....	S	M	Q	**	**	**	**	Excellent, but rots at the core.
Clapp Favorite.....	S	M	Q	**	**	**	**	Very good; fine color; matures rapidly, standard only.
Doyenne d'Ete.....	ES	M	Q	**	**	**	**	Good; very early but small.
Duchesse d'Angouleme.....	S	M	Q	**	**	**	**	Most profitable of all on quince.
Flemish Beauty.....	S	M	Q	**	**	**	**	Good, but liable to rot at core.
Garber.....	S	M	Q	**	**	**	**	Oriental type, good, follows Leconte.
Howell.....	S	M	Q	**	**	**	**	Very good.
Kieffer.....	A	M	Q	**	**	**	**	Productive and valuable as a late pear.
Lawrence.....	S	M	Q	**	**	**	**	Large and fine; fine grower; best on standard.
Louise Bonne d'Jersey.....	S	M	Q	**	**	**	**	Variable as to quality.
Leconte, <i>syn.</i> , <i>Chinese Pear</i> .....	S	M	Q	**	**	**	**	Valuable in South Georgia; very good
Mikado.....	S	M	Q	**	**	**	**	Good for canning. [for table and market
Mme. Von Seibold.....	A	M	Q	**	**	**	**	Good for canning.
Onondaga.....	ES	M	Q	**	**	**	**	Vigorous grower; good quality.
Osband Summer.....	S	M	Q	**	**	**	**	
Ott.....	VE	M	Q	**	**	**	**	Small, but excellent and productive.
Petite Marguerite.....	S	M	Q	**	**	**	**	Seedling of Doyenne d'Ete, and better.
St. Michael Archangel.....	S	M	Q	**	**	**	**	
Seckel.....	S	M	Q	**	**	**	**	Fine grower; good fruit.
Sheldon.....	L	T	Q	**	**	**	**	Slower bearer; fruit best quality.
Steven Genessee.....	S	M	Q	**	**	**	**	
Smith.....	VT	M	Q	**	**	**	**	
Wilder.....	T	S	Q	**	**	**	**	Oriental type; resembles Leconte, but [little earlier Showy small, good but slow bearer.

## BEST VARIETIES FOR MARKET IN ORDER OF MATURITY.

ON QUINCE—Beurre Giffard, St. Michael Archangel, Howell, Duchesse d'Angouleme, Seckel, Beurre d'Anjou.

ON STANDARD—Doyenne d'Ete, Wilder, Clapp Favorite, Beurre Superfin, Bartlett, Belle Lucrative, LeConte, Flemish Beauty, Seckel, Beurre Clairgeau, Lawrence, Kieffer, Beurre Easter.

ORIENTAL TYPE—Mikado, Garber, Mme. Von Seibold. Very productive, and valuable for canning and evaporating only.

# PLUMS.

(Native and European.)

EXPLANATION OF COLUMNS—1st, name of variety; 2d, color; 3d, class—whether free or clingstone; 4th, season; remainder, region in which the varieties are recommended.

ABBREVIATIONS—Color—R, red; Y, yellow; B, blue; G, green; P, purple or purplish. Season—As for Peaches. Class—C, clingstone; F, freestone.

NAME	Color.	Class.	Season	Rating.			REMARKS.
				Mountain Region.	Middle Region.	Southern Region.	
				Coast Region.			
<i>Group—Americana.</i>							
Hanson	YR	C	M&L	*	*	*	Only fairly reliable plum of its class Large, oblong, best quality.
Smith	YR	C	M&L	*	*	*	
<i>Group—Hortulana, Minor Type.</i>							
Wilder	R	C	M	**	*	*	Excellent; succeeds Clifford.
<i>Wayland Type.</i>							
Cumberland	Y	C	VL	*	*	*	Productive; poor quality.
<i>Wild Goose Type.</i>							
Clifford	R	C	E	*	*	*	Excellent quality; good shipper. Inferior to Clifford and Wilder.
Wild Goose	YR	C	E	*	*	*	
<i>Group—Chickasaw.</i>							
Beatty	R	C	M&L	*	*	*	Very productive; season lasts 6 weeks Overproductive; holds fruit 5 weeks Productive, juicy; good family plum
Hughes	R	C	M&L	*	*	*	
Mudson	YR	C	VE	*	*	*	
<i>Group—Cerasifera.</i>							
DeCaradenc	R	C	VE	*	*	*	Very productive; good shipper, but inferior quality.
<i>Group—Myrabolana, Pissard (Prunus Pissardii, or Persian Purple-leaved.)</i>							
		C		*	*	*	Valuable only as ornamental plant.
<i>Group—European.</i>							
Bradshaw	R	F	M	*	*	*	The Curculio and brown rot prevent this class of plums from being raised to any extent. Where special care is taken to destroy the insects, the varieties marked * are recommended.
Coe's Golden Drop	Y	F	M	*	*	*	
Columbia	P	F	M	*	*	*	
Damson, syn., Black	B	F	E	**	**	*	
Duane's Purple	P	C	M	*	*	*	
Green Gage	G	F	M	*	*	*	
Imperial Gage	G	F	M	*	*	*	
Lombard	P	C	M	*	*	*	
Mogul, syn., Morocco	B	C	M	*	*	*	
Monroe	G		M	*	*	*	
Moore's (Aretic)	P		M	*	*	*	Good quality in mountains.
Orleans (Smith's)	P	F	M	*	*	*	
Red Gage	P	F	M	*	**	*	Profuse bearer.
Shipper's Pride	P		M	*	*	*	
Washington	Y	F	M	*	*	*	
Yellow Gage	Y	F	M	*	*	*	

# JAPANESE PLUMS.

*Prunus Tridora* of Botanists—*Prunus Japonica* of Pomologists.

For many years past efforts have been made to simplify their nomenclature and remove the perplexing synonymy resulting from the Japanese names, which usually refer to a class or type or the locality from which trees are exported, and have resulted in the confusion which has existed in their nomenclature. Specific names have lately been adopted by leading American Pomologists, and plums disseminated under these.

ABBREVIATIONS AND EXPLANATIONS—Same as for Native and European Plums. Synonyms entered in small type after the accepted name of each variety.

NAME	Color.	Class.	Maturity.	Rating.			REMARKS.
				Mountain Region.	Middle Region.	Southern Region.	
Abundance .....	YR	C	E	*	**	*	One of the best; reliable; good quality and shipper.
<i>Botan</i>							
<i>Yellow Flesh Botan</i>							
Babcock .....	R	C	VL				Differs but slightly, if any, from Chabot
<i>Chabot (P)</i>							
Berckmans .....	YR	C	M	*			Quality good in some sections; appearance attractive.
<i>True Sweet Botan</i>							
Burbank .....	YR	C	L	*	**	*	Large; apt to overbear; of drooping habit; good shipper.
<i>Wassu</i>							
Chabot .....	R	C	VL	*	**	*	Excellent late variety; good shipper.
<i>Bailey</i>							
<i>Chase</i>							
<i>Furujiya</i>							
<i>O'Hattankio</i>							
Douglas .....	R	C	VL	**	*	*	Closely resembles Chabot.
<i>Hylankayo</i>							
<i>Munson</i>							
Georgeson .....	Y	C	L	*	*	*	Good quality; suitable for local market
<i>Hattankio No. 1.</i>							
<i>Mikado</i>							
Kelsey .....	P	SC	VL	*	*	*	Large, excellent quality; variable; rots.
Kerr .....	Y	C	E	*	*	*	Excellent early plum, but weak of constitution.
<i>Hattankio No. 2.</i>							
<i>Oblong Hattankio</i>							
Lutts .....	P	C	VE				Earliest of this list; good size; desirable.
<i>Wasse-Botankio</i>							
Maru .....	R	C	M	*			Weak constitution but of good quality.
<i>Masu</i>							
Nagate-maru .....	R	C	VL				Promising; a late form of Abundance.
Ogon .....	Y	F	E	*			Good freestone; light bearer.
<i>Shiro Smomo</i>							
Red June .....	R	C	VE	*	**	*	One of the best; large and fine; profitable market sort.
<i>Nagate no Botankio</i>							
<i>Red Nagate</i>							
Satsuma .....	P	C	VL	*	*	*	Unreliable in some sections; fine quality, but rots, best for canning.
<i>Yone-momo</i>							
<i>Yone-smomo</i>							
Sagetsuma .....	YR	C	VE				Large; handsome; promising.

# JAPANESE PLUMS—Continued.

NAME	Color.	Class.	Maturity.	Rating.				REMARKS.
				Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
<i>Crossed Varieties:</i>								
America.....	Y R	C	M	...	*	*	...	Productive, but of poor quality.
Bolan & Robinson Apple.....	P	C	L	...	*	...	...	Closely resembles Satsuma.
Satsuma & Robinson	R	C	E	...	...	...	...	Excellent quality; very promising.
Bartlett.....	P	C	L	...	*	...	...	Very large and firm; very promising.
Delaware & Simon	R	C	E	...	...	...	...	Very large; delicious; promising. productive.
Chalco.....	R	C	E	...	...	...	...	
Simon & Burbank	R	C	E	...	...	...	...	
Climax.....	R	C	E	...	...	...	...	
Abundance and Simon	R	C	M	...	**	*	...	
Combination.....	R	C	L	...	*	...	...	
Doris.....	Y R	C	M	...	...	...	...	
Gold.....	Y R	C	M	...	...	...	...	
Robinson and Abundance	Y R	C	M	...	*	*	...	
Gonzales.....	R	C	VL	...	...	...	...	
Wickson.....	R	C	VL	...	...	...	...	
Triflora and Simon.								

## PRUNUS SIMONI.

(Simon's Chinese Apricot Plum.)

A remarkable fruit indeed. This was introduced 24 years ago from China. The tree is of attractive, erect and compact habit; flowers very small; fruit large, flattened, 2 1-2 by 2 3-4 inches broad, by 1 1-2 to 2 inches through, resembling a ripe tomato; flesh yellow, fine grained and firm; juicy, sub-acid and with a remarkable combination of flavors, such as pear, pineapple and muskmelon; quality best; begins to ripen June 15, and lasts one month. The tree is a shy bearer.

## NATIVE GRAPES.

EXPLANATION OF COLUMNS—1st, name; 2d, variety; 3d, season; 4th, use; remaining columns for regions, etc.

ABBREVIATIONS—Color—W, white, B, blue or black; R, red; PB, pale blue. Season—E, early, maturing from beginning to end of July; M, medium, maturing from end of July to August 15; L, late, maturing after middle of August; VL, very late, maturing after middle of September. Use—M, market; T, table; W, wine.

# GRAPES—Continued.

NAME	Color.	Season.	Use.	Rating.			REMARKS
				Mountain Region.	Middle Region.	Southern Region.	
				Coast Region.			
<i>Type Labrusca (or Fox Grape.)</i>							
Catawba.....	R	M	W	*	*	*	[gaining its old standard.
Concord.....	B	M	MW	**	**	**	* Less liable to rot than formerly; re
Cottage.....	B	M	T	...	...	...	Among our best varieties.
Diana.....	PR	M	TM	...	...	...	Of better quality than Concord.
Ives.....	B	M	WM	**	**	**	* Good quality; good bearer and shipper
Moore's.....	B	VE	M	*	*	*	* Prolific and no rot.
Niagara.....	W	M	M	**	**	**	* An early shipper.
Perkins.....	R	M	M	*	*	*	* Profitable as a white market grape.
Worden.....	B	M	M	*	*	*	* Good bearer; no rot; second quality.
							* Larger than Concord.
<i>Labrusca Hybrids:</i>							
E. Victor.....	B	E	T	...	...	...	Extra quality; productive.
Barry (Rogers' 42).....	B	M	T	...	...	...	Good quality; sets poorly.
Brighton.....	R	E	T	...	...	...	Very good quality; good bearer.
Diamond.....	W	E	TM	...	...	...	* Very early; white. [sacking
Duchess.....	W	E	T	...	...	...	* First quality; liable to rot; requires
Empire State.....	W	M	T	...	...	...	* Unreliable in some soils.
Goethe (Rogers' 1).....	PR	L	TW	...	...	...	* Good; late; requires sacking.
Lady Washington.....	W	M	T	...	...	...	* Moderate grower; very large clusters
Lindley (Rogers' 4).....	R	M	T	...	...	...	* Good.
McIntosh (Rogers' 19).....	B	M	T	...	...	...	* Suitable for amateur culture only.
Peter Wylie.....	W	M	T	...	...	...	* Best quality; rots badly.
Salem (Rogers' 53).....	R	M	M	...	...	...	* Good.
<i>Type Aestivalis, (Summer Grape.)</i>							
Carman.....	B	M	TM	...	...	...	Very showy and productive.
Cunningham--syn.,.....	PR	M	W	*	*	*	Good but not productive.
Long.....	B	M	TW	...	...	...	* Excellent; shy bearer while young.
Devereaux--syn.,.....	B	M	TW	...	...	...	* Excellent; shy bearer while young.
Black July.....	B	M	TW	...	...	...	* Excellent; shy bearer while young.
Herbemont--Syn.....	PR	L	W	*	*	*	* Apt to rot; excellent quality. [wine
Warren.....	B	M	W	*	*	*	* Rots in Middle region; excellent for
Lenox.....	B	M	W	*	*	*	* Best for red wine.
Norton's Virginia.....	B	L	W	*	*	*	* Of first quality.
Superb.....	B	E	T	...	...	...	
<i>Aestivalis Hybrids:</i>							
Delaware.....	PR	E	TMW	**	**	**	[grower
Erundel.....	B	E	T	...	...	...	* Best table variety; reliable; slow
							* Of excellent quality; productive.
<i>Type Riparia (or River side Grape.)</i>							
Clinton.....	B	M	W	*	*	*	* Good for red wine.
<i>Riparia Hybrids:</i>							
Bell.....	W	M	T	...	...	...	Of good quality; productive.
Berckmans.....	R	M	T	*	*	*	Vigorous; better grower than Dela're
Canada.....	B	E	T	...	...	...	* Good table grape.
Elvira.....	W	M	W	*	*	*	* Very poor grower.
Missouri Riesling.....	W	M	TW	...	...	...	* Good for white wine.
Noah.....	W	M	T	...	...	...	* For white wine.
Presley.....	R	VE	T	...	...	...	* Hangs a month on vine; good shipper

# **GRAPES—Concluded.**

NAME	Color.	Season.	Use.	Rating.			REMARKS
				Mountain Region.	Middle Region.	Southern Region.	
						Coast Region.	
<i>Type, Rotundifolia.</i>							
Eden .....	B	VE	TW	..	**	...	Excellent quality; prolific.
Flowers .....	B	VL	W	*	*	**	The latest of the type
James .....	B	L	TW	..	*	*	Very large berry; poor quality.
Scuppernong .....	W	L	TW	**	**	**	Most certain bearer; good wine grape
Tenderpulp .....	B	L	TW	*	*	*	Pulp dissolving.
Thomas .....	PB	E	TW	**	**	**	An excellent early variety.
<i>Type Vitifera (European Grape.)</i>							
Welcome .....	B	M	T	..	**	...	Excellent quality; subject to rot.

## **BEST VARIETIES FOR MARKET IN ORDER OF MATURITY.**

**Moore, Diamond, Brighton, Ives, Delaware, Niagara, Concord, Perkins, Diana.**

## **BEST VARIETIES FOR WINE.**

**Red—Norton's Virginia, Lenoir, Clinton, Concord, Ives, Thomas.**

**White—Missouri Riesling, Catawba, Delaware, Elvira, Wafren, Noah, Scuppernong.**

## STRAWBERRIES.

**EXPLANATION OF COLUMNS**—1st, name; 2d, sex; 3d, origin; 4th, use; 5th, season.

**ABBREVIATIONS**—Sex—P, Pistillate; H, hermaphrodite or bisexual. Use—F, family; M, market; LM, local market. Season—E, early; VE, very early; L, late.

NAME	Sex.	Use.	Season.	Rating.			REMARKS.
				Northern Region.	Middle Region.	Southern Region.	
Bederwood.....	H	LM	E	...	*	...	Very productive, but small.
Belmont.....	H	F	M	...	*	...	Long; suitable for rich soil.
Brandywine.....	H	M	M&L	...	*	...	Large; productive.
Bubach (No. 5).....	P	M	L	**	**	...	Excellent.
Clyde.....	H	LM	M	...	*	...	Excellent for family use and local market.
Cumberland.....	H	M	M	...	*	...	
Excelsior.....	H	FM	VE	...	*	...	Early but small.
Gandy.....	H	FM	VL	...	*	...	Excellent late berry; very large.
Greenville.....	SP	F	M	...	*	...	A light bearer; good size.
Haverland.....	P	M	L	*	*	...	Productive; large and long.
Hefflin.....	H	LM	E	...	*	...	Very large and handsome.
Hoffman.....	H	M	VE	...	*	**	Standard early shipper in some sect's
Howell.....	H	LM	M	...	*	...	Promising.
Lady Thompson.....	H	M	E	**	**	**	Best market variety.
Michel.....	H	M	VE	*	*	...	Very early; shy bearer.
Pride of Cumberland.....	H	FM	L	...	*	...	Large, productive; desirable.
Sample.....	P	FM	L	...	*	...	Large, productive; desirable.
Seaford.....	P	LM	M	...	*	...	Excellent quality; large.
Sharpless.....	H	F	M	*	*	...	Size large and quality good.
Wilson.....	H	M	M&L	...	**	**	An old favorite.

## RASPBERRIES.

(EXPLANATIONS AND ABBREVIATIONS as for other fruits.)

NAME	Size.	Color.	Season.	Rating.				REMARKS
				Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
1. Black Caps:								
Conrath.....	L	B	E	*	...	...	...	Very promising; large and fine.
Cumberland.....	M	B	M	*	...	...	...	Heavy cropper.
Gregg.....	M	B	M	**	...	...	...	Best of black-caps; an old standard.
Souhegan.....	S	B	E	**	...	...	...	Early.
2. American Reds:								
Cuthbert.....	L	R	M	**	**	...	...	Best and most reliable.
Golden Queen.....	M	Y	M	*	*	...	...	Productive and of first quality.
King.....	M	R	M	*	*	...	...	Promising.
Loudon.....	L	R	M	**	*	...	...	Large, handsome, heavy.
Miller.....	M	R	E	*	*	...	...	Promising.
Turner.....	..	R	M	*	*	...	...	Heavy bearer; of good quality.
3. Purple Cane Group:								
Caroline.....	M	Y	E	*	...	...	...	Handsome; productive.
Columbian.....	L	P	E	*	*	...	...	Vigorous and productive; best of its group
Reliance.....	M	P	M	*	*	...	...	Good. [to drouth
Shaffer.....	L	P	L	...	...	...	...	Late; productive; good shipper; succumbs

## BLACKBERRIES.

NAME	Size.	Color.	Season.	Rating.				REMARKS.
				Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
Maye's.....	L	B	VE	..	..	..	..	A large Dewberry; profitable for mar-
Dallas.....	M	B	VE	..	..	..	..	Early; productive. [ket
Early Cluster.....	L	B	E	..	..	..	..	Very handsome; early.
Erie.....	L	B	M	..	..	..	..	One of the best.
Early Harvest.....	S	B	VE	..	..	..	..	Valuable as a very early berry.
Iceberg.....	M	B	M	..	..	..	..	Best white berry; productive.
Kittatunny.....	M	W	E	..	..	..	..	An old standard.
Ohmer.....	VL	B	M	..	..	..	..	Handsome and productive.
Stone.....	M	B	L	..	..	..	..	A good late berry.
Taylor.....	M	B	VL	..	..	..	..	Good quality.
Wilson's.....	L	B	E	..	..	..	..	

## MULBERRIES.

Downing's.....	M	P	E&L	..	**	**	**	Good flavor, acid; moderate bearer.
Hicks'.....	M	P	E&L	..	**	**	**	Inferior fruit; very prolific; recom-
Stables'.....	VL	P	E&L	**	**	**	*	mended for poultry and hogs. Large; very best; immensely product-
								ive.

# FIGS.

**EXPLANATION OF COLUMNS**—1st, name; 2d, size; 3d, color; 4th, season; remaining columns for regions, etc.

**ABBREVIATIONS**—Size—S, small; L, large; M, medium; Color—W, white. Season—E, early; M, middle season; E and L, early and late.

NAME	Size.	Color.	Season.	Rating.			REMARKS
				Mountain Region.	Middle Region.	Southern Region.	
						Coast Region.	
Angellique, <i>syn.</i> , <i>Early Lemon</i> .....	S	W	E	*	*	*	Small; good; early.
Brunswick, <i>syn.</i> , <i>Madonna, Con'sple</i> ....	L	P	L	**	*	*	Very large and desirable; shy bearer.
Blue Genoa .....	M	P	M	**	*	*	
Black Ischia .....	M	P	M	**	*	*	Good quality.
Black Provence .....	S	B	EL	**	*	*	A good second to Celestial.
Brown Turkey .....	M	B	L	**	*	*	Best of all f. r middle region.
Brown Smyrna .....	M	B	M	*	*	*	Very good and prolific; sours badly.
Celestial .....	S	V	E	**	*	*	Small; prolific and desirable.
Green Ischia, <i>syn.</i> , <i>White Ischia, Green</i> <i>Italian</i> .....	M	G	ML	**	*	*	Very good; excellent quality.
Japan .....				**	*	*	Productive; poor quality.
Lemon .....	M	V	M	**	*	*	Good.
Marseilles .....	M	W	M	*	*	*	Good; very early.
Neyrell .....	S	W	L	*	*	*	
Violet Round .....	M	W	M	*	*	*	Rather dry, but prolific.
White Adriatic .....				*	*	*	Excellent quality; prolific but tender.

## CHERRIES.

Explanations and abbreviations same Figs, except color. R, red; A, amber; DR, dark red, or nearly black; Y, yellow; YR, yellow red.

NAME	Size.	Color.	Season.	Rating.			REMARKS.
				Mountain Region.	Middle Region.	Coast Region.	
Belle de Choisy .....	M	DR	M	*	*		<p>Very early. Cherries are uncertain in Middle region, except in a few localities, where good crops are sometimes produced, the Morello class being most desirable. Trees should all be grown on Mahaleb stock.</p>
Belle et Magnifique ..	M	R	M	*	*		
Black Heart, Wer-							
der's .....	L	DR	E	*	*		
Black Tartarian .....	L	DR	M	*	*		
Black Eagle .....	L	DR	M	*	*		
Coe's Transparent .....	S	AY	M	*	*		
Dyehouse .....	M	R		*	*		
Early's Richmond .....	M	R	E	*	*		
English Morello .....	M	R	L	*	*		
Governor Wood .....	L	R	M	*	*		
May Duke .....	L	R	E	*	*		
Montmorency ( <i>Ord-</i>							
<i>naire</i> ) .....	M	R	L	*	*		
Napoleon .....	L	R	M	*	*		
Rockport .....	L	AR	E	*	*		
Reine Hortense .....	L	R	M	*	*		
Wragg .....	M	P	L	*	*		
Yellow Spanish .....	J.	R	M	*	*		

## QUINCES.

NAME	Rating.			REMARKS
	Mountain Region.	Middle Region.	Coast Region.	
Angers .....	*	*	*	Fine quality.
Chinese .....	*	*	*	Succeeds best in Southwest Ga., good for preserving
Orange or Apple .....	*	*	*	Most generally cultivated.
Portugal .....	*	*	*	Large and good.
Rose's Mammoth .....	*	*	*	

Quinces need strong clay soil. They are unproductive in gray land, except Chinese.

## JAPAN PERSIMMONS.

(*Diospyros Kaki*.)

It is almost impossible to give an accurate nomenclature, owing to the confusion which exists in the collections imported from Japan. These collections seldom contain more than twelve varieties; yet, when the trees bear fruit, the same name is often used to apply to several distinct varieties, or one variety has several names. The best and most distinct varieties have been included in this list, and with such synonyms added thereto as have been ascertained after several years' trial; and while no claim is laid to strict accuracy, the aim has been to reach this as nearly as possible.

All the varieties are hardy in the Middle and Coast Regions, and occasionally in the Mountain Region.

The fruit is usually of a bright orange red or vermillion, the color being more or less intense, according to variety, and begins to color when half grown, but should be allowed to hang upon the trees until just before frost is expected; or, with the early ripening varieties, until fully soft. If gathered before frost there is a slight astringency next to the skin, but this disappears after being kept in the house for a few days or weeks. If allowed to be slightly touched by frost, the flavor is much improved, but it will then not keep many days. It is, therefore, desirable to gather the fruit before frost, if intended for keeping, and then some varieties will keep until January or February. The flesh is soft, rich and sweet, and with a slight apricot flavor. The fruit should be eaten with a spoon.

Some varieties are apt to overbear, and should have the fruit thinned as soon as set in April.

Trees are propagated mainly by grafting upon the collar of the roots and upon the native species. Seedlings vary in size, shape and quality, but the largest proportion are male plants, and those which are fruitful, are apt to produce small and worthless fruit; very little reliability can, therefore, be placed upon seedlings, so far as yielding edible fruit.

*Among*, or *Yemon* (name of a Japanese ornament). Round, flattened, deeply ribbed, dark orange red, and sometimes yellowish red, two and a half to three inches in diameter, average weight six ounces, and occasionally a specimen weighing sixteen ounces is produced. Very sweet, flesh red, and is edible while still solid; quality improves as it becomes soft. Maturity, September to end of November. Trees of moderate height.

*Hachiya* ("Beehive" in Japanese). Synonyms: *Costata*, *Imperial*, *Yomato*, etc. Oblong, with blunt apex, slightly ribbed, two and a half by three inches; average weight five ounces. Flesh deep orange red;

astringent while solid, but sweet and very good when soft. Should be house-ripened, and can be kept until March. Tree of vigorous and tall growth.

*Hiyakume* (weighs one hundred "me," a unit of Japanese weight). This is perhaps the most desirable of all the round, red flesh varieties, and as the fruit affects various shapes, it is known under many names, such as Pound, Tane-nasahi, or Seedless, etc. The Agricultural Bureau of Tokio gives the latter name to a variety with black mottled apex, but we find both round and elongated forms upon the same tree, as also uniformly orange and orange yellow colored specimens, while many are heavily tipped with black. The variation of forms and colors doubtless led to its array of synonyms. Fruit large, average three inches in diameter, and five ounces in weight; usually flattened, but elongated forms are quite common upon the same branch. Flesh bright orange red. Keeps very late. Must be soft before being edible. Tree of moderate height; apt to be of dwarf growth.

*Ioyama Gaki* (name of locality). Medium to large, round, but somewhat narrower at the apex; yellowish orange, with dark black pencilings at apex. Flesh dark brown or grayish brown; very sweet. Can be eaten when solid; four to six ounces.

*Kurokumo* (This may possibly be Goshio-hira, or Palace Persimmon). Very large, round, somewhat flattened; three to three and a half inches in diameter; average weight ten ounces, and sometimes yields specimens of sixteen ounces in weight; keeps late. Flesh red. Tree erect grower.

*Miyo-tan*. Synonym: Mazelli. Round or slightly oblong, two and a half inches in diameter; average weight five and a half ounces; slightly ribbed. Skin deep orange red. Flesh usually deep brown red; but bright red or half red and half brown fleshed specimens are often produced upon the same tree, the results of cross-fertilization by other varieties. Tree of medium or dwarf growth; exceedingly prolific. Fruit keeps very late. The brown-fleshed specimens are edible while solid, and as early as October 1.

*Okame* ("Stout young girl" in Japanese). Synonyms: Oblong Hyakume, Mikado, etc.; medium to large, two and a half by three and a half inches; deep red; nearly always seedless; keeps late.

*Tsuru-no-ko* ("Stork Egg"). Synonym: Minokaki ("Persimmon from Mino," a locality). Large, oblong, pointed, two and a half by three and a half inches; weight four to five ounces, sometimes ten ounces. Skin bright red; some specimens black at apex. Flesh red, very good. Keeps late. Edible only when soft. Foliage long and shiny; tree compact and vigorous grower. This variety varies very much as to size at different seasons.

***Yedo-Ichi*** ("No. 1," or "Best in Yedo," latter being the old name of Tokio). Synonym: ***Maru-Gata*** ("round shape.") Medium, round, some specimens slightly oblong, flattened at base and narrowing at apex, skin dark red, often with black mottlings near apex; flesh mahogany brown, with darker spots, brittle and is edible while solid, as early as October 1. Very prolific and bears fruit in large clusters. Tree an upright grower.

***Zenji***, or ***Zingi*** (name of Japanese village)—Small, one and three-fourths by two inches; weight three to four ounces. Flesh dark brown, with darker spots very sweet. Edible as early as middle of September, while still solid, and lasts throughout October.

# GEORGIA

## State Board of Entomology

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BULLETIN NO. 28, MARCH 1909.

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### **“BLACK ROOT” DISEASE of Cotton in Georgia and its Control.**

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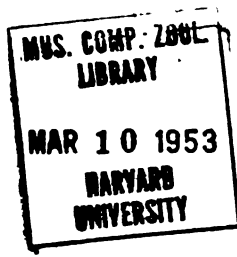
**This Bulletin contains a brief summary on investigations and  
experiments conducted from 1905 to 1908.**

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BY  
**A. C. LEWIS**  
Assistant State Entomologist



CAPITOL BUILDING  
**Atlanta - - - Georgia.**



## **Georgia State Board of Entomology.**

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## ACKNOWLEDGEMENTS

Without the generous co-operation of different cotton planters who have tested our resistant cotton seed and made a report to us upon the same, the work reported upon in this bulletin could not have been carried out so successfully, and we wish to thank all of these gentlemen. We feel grateful not only for the reports received, but also for the interest that the planters have shown in the investigation.

We desire to thank especially the following gentlemen:

Prof. W. A. Orton, of the Bureau of Plant Industry, Washington, D. C., for the many valuable suggestions given in the beginning of the work, and for furnishing us seed of the Dillon and Dixie cottons for planting in 1905.

Hon. B. S. Miller, Columbus, Ga., for furnishing land at Zellobee on which experiments were conducted in 1905, 1906 and 1907.

Mr. Ed. Howell, Vienna, Ga., for furnishing land for experimental purposes in 1906, 1907 and 1908.

Mr. J. R. Jordan, Pelham, Ga., for land furnished for experimental purposes in 1908.

Col. W. D. Hammack, Coleman, Ga., for testing and growing for us different selections and hybrids.

Parties desiring to purchase resistant cotton seed may be able to secure them from the following parties, who have been growing the resistant cotton for several years.

Mr. Ed. Howell, Vienna, Ga., has grown the Dillon, Dixie and Resistant Strain of Excelsior.

Mr. O. A. Bozeman, Ashburn, Ga., has grown the Dixie.

Mr. G. L. Collins, Arlington, Ga., has grown the Dillon.

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# **"BLACK ROOT" DISEASE OF COTTON**

## **IN GEORGIA AND ITS CONTROL**

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BY A. C. LEWIS.

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### **INTRODUCTION.**

In Bulletin No. 22, of the Georgia State Board of Entomology, issued December, 1906, the "Black Root" disease of cotton was described in detail. In this bulletin a report was also made on the experiments conducted in 1905-1906. Since then the experiments have been continued along the same line on a much larger scale with very valuable and gratifying results. The results reported before, have been confirmed and certain factors have proven to be of prime importance in the control of the disease. In order that these latest results may be placed in the cotton growers hands at once it is deemed advisable to issue this bulletin at this time. It is believed that if the recommendations given are followed this season and in the future by the cotton growers who have the disease on their farms, it will result in a great saving to them.

### **DISTRIBUTION.**

The "black root" or "wilt" disease of cotton, as it is sometimes called, is now known to occur in the following States: North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Arkansas and Louisiana.

In Georgia we know the disease occurs in the following counties: Berrien, Bibb, Brooks, Burke, Calhoun, Chattahoochee, Colquitt, Columbia, Coweta, Crisp, Dooly, Dougherty, Early, Effingham, Emanuel, Grady, Harris, Houston, Irwin, Laurens, Lee, Lowndes, Macon, Marion, McDuffie, Montgomery, Muscogee, Pierce, Pulaski, Randolph, Richmond, Schley, Stewart, Sumter, Talbot, Terrell, Telfair, Thomas, Troup, Washington, Webster and Worth.\*

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\*Probably occurs in other counties also. The distribution as given was determined by personal investigation, in a majority of the counties, and also from correspondents who sent specimens of diseased plants to be identified.

## ANNUAL LOSS FROM "BLACK ROOT."

The annual loss to the cotton growers in Georgia from black root is very great, amounting at least to tens of thousands of dollars. The following cases which have come under observation will show how heavy the loss has been to some individuals: In 1904 Hon. B. S. Miller placed the loss on his plantation at Zellobee from \$1,000.00 to \$1,500.00. In 1905 Mr. Ed. Howell, Vienna, Ga., placed his loss at the same amount. In 1908 Mr. C. C. Clay, Cobb, Ga., lost from ten to fifteen bales, and Mr. C. R. Whitley, Americus, Ga., lost as much if not more than Mr. Clay. In many fields we have seen from one to five acres killed outright, and the remainder of the field stunted so as to greatly reduce the yield. Prof. W. A. Orton estimates the annual loss from black root in the infected States at \$2,000,000.00.\* Figuring upon this basis a conservative estimate of the loss each year in Georgia is about \$200,000.00.



Fig. 1—Cotton Plant Dying from "Black Root" Disease. From photo by Willmon Newell.

\*Farmer's Bulletin, U. S. Department of Agriculture, No. 333, p. 7.

## EXTERNAL SYMPTOMS.

The first outward symptom of black root is generally a wilting of some of the leaves as shown in Fig. 1. Many of the young plants die within a few days after the first symptoms of the disease appear, which is usually when they are about six weeks old. Plants will continue to die now and then until frost. Some of the plants attacked may partially recover from the disease, and put out side branches near the ground, but as a rule these branches do not produce much cotton. In the course of time plants killed by the black root disease lose all their leaves, and the small branches drop off leaving only the blackened stem standing. Many plants that are not killed outright by the disease are much stunted in growth and their yield reduced. This phase of the disease is often overlooked by many planters. In several instances nearly whole fields have been found in this stunted condition and the owner was not even aware that the cotton was diseased.

## INTERNAL SYMPTOMS.

The internal symptoms of this disease are very characteristic, so that it is not difficult to tell black root from any other disease that cotton is subject to in Georgia. If the roots and stem of a diseased plant are examined by cutting lengthwise, it will be found that the woody portions are black or much discolored. This is the symptom that has given the disease the name "black root."

## THE CAUSE OF BLACK ROOT.

The cause of the cotton disease commonly called "black root" or "wilt" is a fungus, *Neocosmospora vasinfecta* (Atk.) Erw. Sm., which attacks the roots and stems of the plants. During the winter the fungus lives on the decaying cotton roots and stems and in the soil mainly in the form of spores. (The spores corresponding to the seeds of the higher plants.) In the spring when the cotton begins to form rootlets and roots these are attacked by the fungus. The fungus penetrates the roots and grows up into the stem following the water ducts and plugging them with its mycelium. This prevents the upward flow of sap from the roots, thus cutting off the food supply and stunting or killing the plants.

## PLANTS ATTACKED BY THE FUNGUS.

So far as known cotton and okra are the only plants the black root fungus lives on as a parasite. In some parts of the State cowpeas wilt and die in much the same way as cotton. This disease is caused by a fungus which is closely related to the fungus that attacks cotton. On this kind of land the Iron cowpea should be planted, as it is very

about the 10th. of June. In this case I think the weather conditions had more to do with the results than the late planting, the weather being dry and warm for some time after the cotton was replanted.

## COMPARATIVE RESISTANCE OF DIFFERENT VARIETIES OF COTTON

In our experiments we have tested so far 48 varieties of cotton, to see if we could find a variety that would be resistant to the black root disease of cotton. The different varieties showed great variation in resistance to the disease, but none of them were resistant enough to be worth propagating for this purpose. In all but one of the varieties, namely, Red Shank, 50 per cent. or more of the cotton died from the black root disease. While the Red Shank was somewhat resistant, 45 per cent. dying, it was discarded on account of its poor yield.

Of the long staple cottons tested only one the Mitañi showed any marked resistance, and this variety is not adapted to Georgia conditions.

In the following list the figures after each variety show the per cent. of cotton that died from the black root disease. In each case here and elsewhere in this bulletin the percentage of dead cotton was determined by actual count made as follows: A few days after the cotton had been chopped out to a stand a count was made of the number of stalks in each plat, and at the last picking the live stalks were counted. Stalks nearly dead or badly stunted, enough to be of no value, were counted as dead.

### List of Varieties Tested and Per Cent. of Each that Died.

#### SHORT STAPLE OR UPLAND COTTONS.

Variety	Per cent. dead.	Variety	Per cent. dead.
Red Shank .....	45	Keenan .....	65
Corley's Wonderful .....	54	King's Improved .....	65
Boykin .....	55	Storm Proof .....	65
Shank High .....	55	Baughn's .....	66
Schley .....	55	Texas Oak .....	66
Hawkins .....	56	Southern Hope .....	66
Lewis' Prize .....	57	Columbia .....	70
Tool's Prolific .....	58	Gold Standard .....	70
Rowden .....	59	Hardin .....	72
Augusta Cluster .....	60	Poulnot .....	77
Triumph .....	60	Excelsior .....	78
Dongola .....	61	Broadwell's Double-jointed .....	80
Bates .....	61	Brancroft Herlong .....	80
Drake's Cluster .....	62	Gold Coin .....	80
Texas Wood .....	62	Peterkin .....	81
Allen Big Boll .....	64	King's Early .....	87
Layton .....	64	Cook .....	95
Pride of Georgia .....	64	Culpepper .....	95
Willet's Red Leaf .....	64	Russell .....	96

# LONG STAPLE COTTONS.

Variety	Per cent. dead.	Variety	Per cent. dead.
Mitaffi .....	22	Sea Island .....	66
Floradora .....	50	Boyd's Prolific .....	66
Sunflower .....	50	Clarksessville .....	70
Allen .....	63	Ounce Boll .....	70
Griffen .....	64	Edisto Sea Island .....	83

# TESTS OF DILLON AND DIXIE COTTONS.

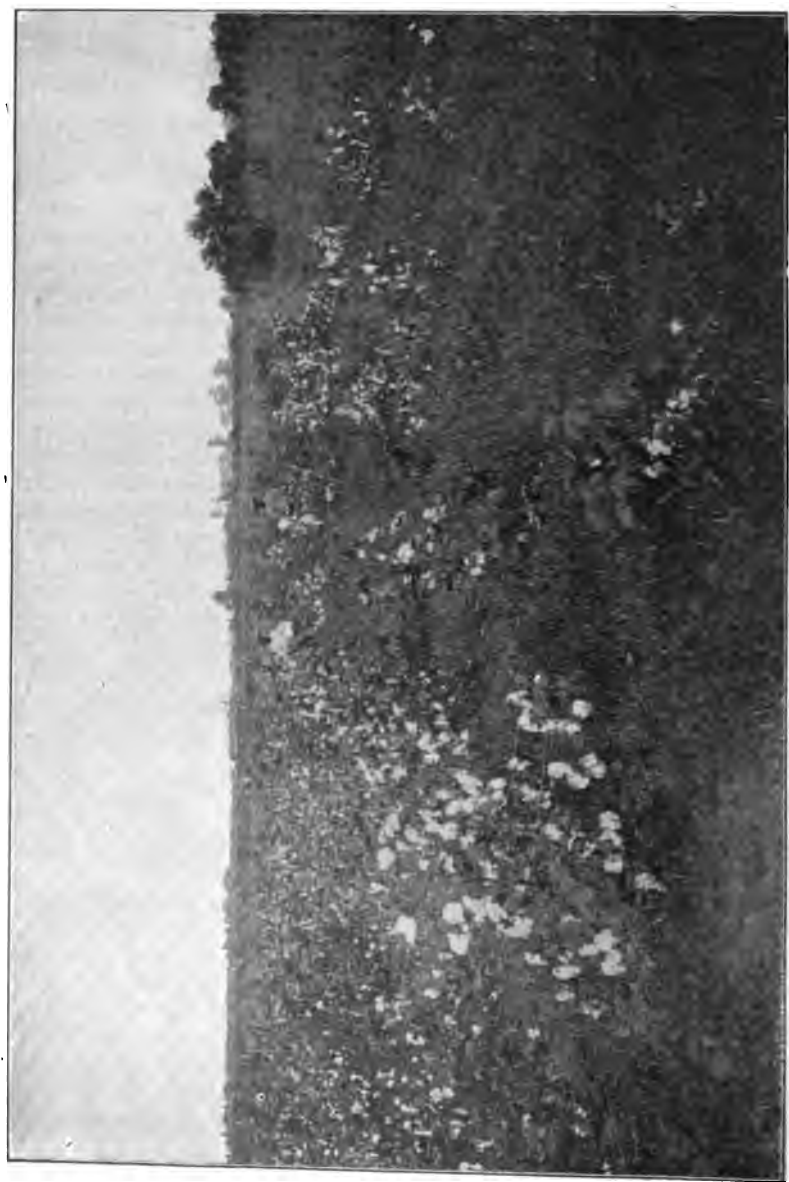
These two varieties of cotton were originated by Prof. W. A. Orton, of the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. In variety tests made in 1900 by Prof. W. A. Orton, the Jackson Limbless was found to be the most resistant to the disease of the varieties tested. By continued selection of the most resistant plants from this variety he has secured a strain of this type of cotton which is very resistant to the black root disease of cotton. This resistant strain he has named the Dillon. The Dixie originated from a selection made by Prof. W. A. Orton, in Alabama in 1901. In 1905 Prof. Orton kindly furnished us some seed of both of these varieties. Each year in our tests they have proven to be quite resistant to the disease, only 10 per cent. to 15 per cent. dying, where 75 per cent. to 95 per cent. of the ordinary varieties died. Fig. 2 shows the comparative resistance of the Dixie and Native Green Seed.

# RELATION OF NEMATODE WORMS TO BLACK ROOT.

Many farmers in Georgia know from dear experience that cotton frequently dies very badly when planted after the common cowpea. That this is due to the fact that the cowpea increases the number of nematodes in the soil and that their presence in the cotton roots increases the severity of the black root disease of cotton is well known.

The nematode worm, *Heterodera radiculicola* (Greff. Mul.) is a parasite which infests the roots of many plants, and causes the knots commonly known as nematode galls. Affected plants are very much stunted and sometimes killed. A few weeds and a great number of cultivated plants are subject to attack by the nematode worms. The most common of these in Georgia are: Cotton, cowpeas (all varieties except the Iron), watermelons, cucumbers, cantaloupe, sugar cane, okra, cabbage, collard, potato, sweet potato, tobacco, mulberry, peaches and figs. In addition to the above Prof. Atkinson mentions the following plants as being badly affected in Alabama: Citron, bird's foot clover (*Lotus corniculatus*), rutabaga, parsnip and salsify.\* In Farmer's bulletin No. 333 Prof. W. A. Orton mentions the following weeds as being subject to attack by the nematode worms; purslane, pigweed, (*Amaranthus*),

\*Alabama Experiment Station, Bulletin No. 9, new series, 1899.



**Fig. 2—Variety Test: On left, U. S. No. 148 or Dixie cotton; on right, Native Green Seed. Shows great difference in resistance to Black Root disease. Original.**

"May-pop," "Indian potato" and "Saw brier." Prof. Orton also states that "Bermuda grass, chufas, and summer oats are slightly susceptible, but probably can be used in rotation when root-knot is only slightly prevalent."

All of our experiments and observations go to show that crops which support the nematodes should be avoided if it is desired to raise cotton on the land. Thus at Vienna, Georgia, on Mr. Ed. Howell's place a field was sown in oats in the fall of 1906. The next summer after the oats were cut, part of the field was sown in cowpeas. In the spring of 1908 the whole field was planted in the Dillon and Dixie resistant cotton. The cotton planted after the cowpeas, died very badly, in spots from 25 per cent. to 50 per cent., while on the other part of the field not over 10 per cent. to 15 per cent. died.

In 1905 at Zellobee, Georgia, a plat of land was sown in sorghum, on which in 1904 from 75 per cent. to 95 per cent. of the cotton died from the black root disease. In 1906 this plat was planted in corn, and just before the last cultivation Iron cowpeas were sown. In 1907 the plat was planted with Dixie and Native Green seed cotton with

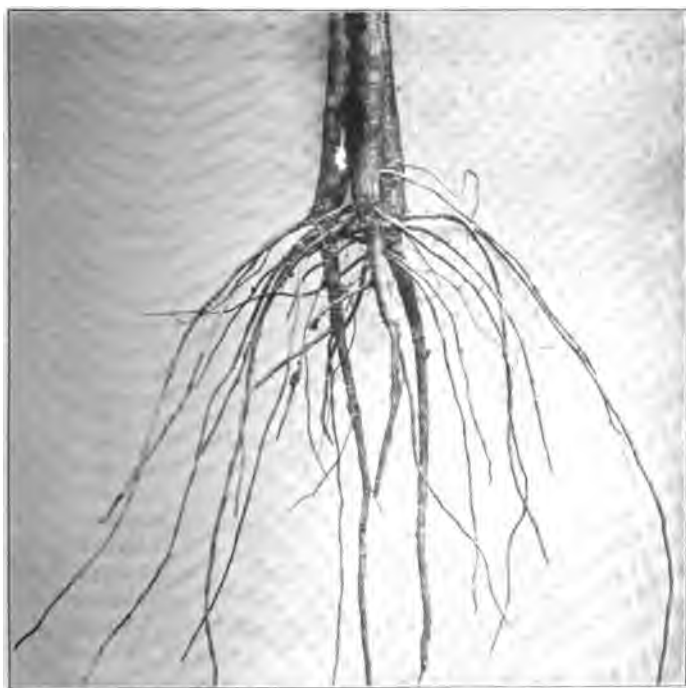


Fig. 8—Iron Cowpea. Roots are Free from Nematode Galls. Original.

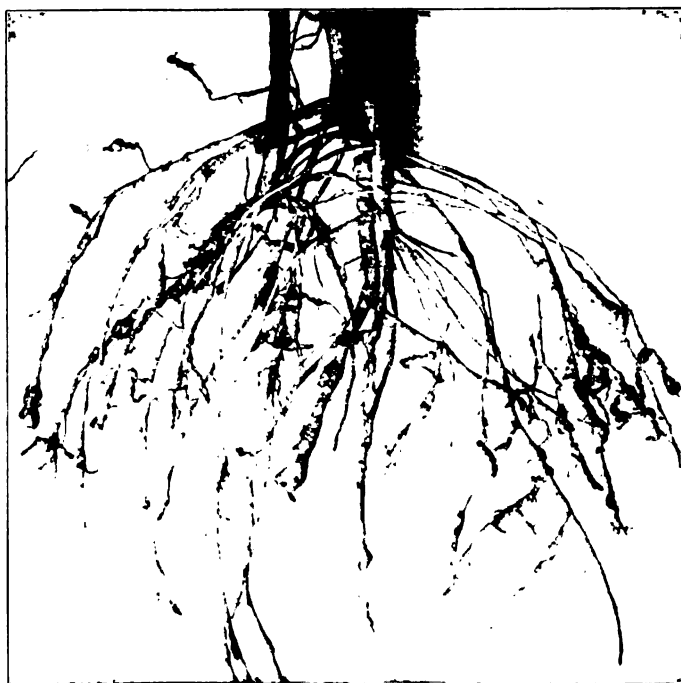


Fig. 4—Nematode Galls on Roots of Unknown Cowpea. Original.

the following results: About 25 per cent. of the Native Green Seed cotton died, and only 5 per cent. of the Dixie cotton. Another very marked difference between this and another adjoining plat which had been in cotton continuously for five years, was that the cotton on the plat which had been in cotton for two years was twice as tall as that on the other plat, and yielded at the rate of a bale per acre.

This experiment shows the importance of rotation of crops in controlling the nematodes and the black root disease of cotton. In the above and other experiments we failed to find any nematode galls on the roots of the Iron cowpea. The roots of the Iron cowpea are shown in Fig. 3, and in Fig. 4, the roots of the Unknown cowpea are shown, notice the galls on the roots of the Unknown cowpea. Fig. 5, shows nematode galls on cantaloupe roots. We can not too strongly advocate the planting of this valuable cowpea, the Iron, on land infested with nematode worms.

In addition to the Iron cowpea any of the following crops may be

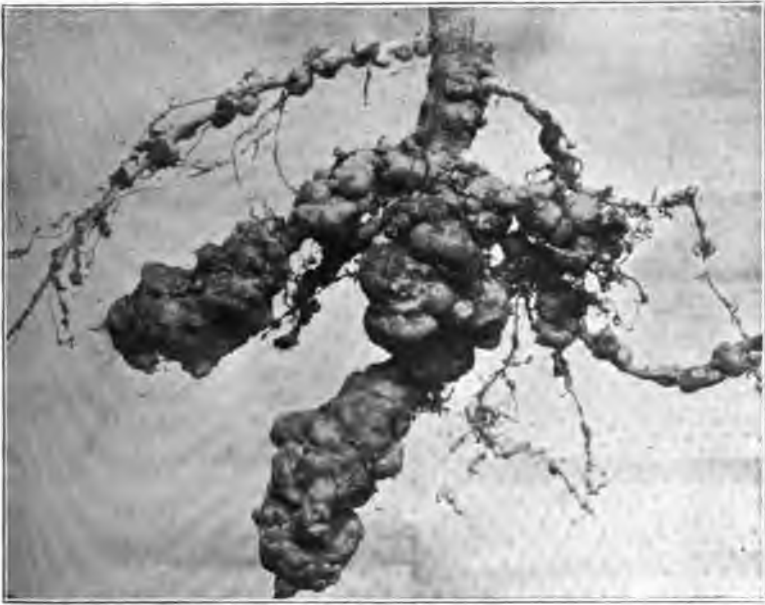


Fig. 5—Nematode Galls on Canteloupe Roots. Original.

used in the rotation, as they will not support the black root fungus nor increase the number of nematodes in the soil; corn, wheat, rye, oats, velvet bean, peanut, and hairy vetch.

#### SELECTION OF SEED FROM RESISTANT PLANTS.

No doubt many cotton planters have noticed that in a badly affected area where nearly all the plants die, or are badly stunted, there may be a few plants that are apparently thrifty and resisting the disease. Such a plant is shown in Fig. 6. Evidently these plants are exposed to the disease to a greater or less extent, but do not succumb from some inherent cause. Knowing that Prof. W. A. Orton had by careful selection greatly improved the resistance of the Jackson cotton and originated the Dixie resistant cotton, we at once began work along the same line to see if we could secure a resistant strain of cotton from some of the varieties commonly grown in Georgia.

#### METHOD OF SELECTING SEED.

Some cotton growers make a practice of going through their fields, picking cotton from the best stalks, and planting the seed to improve



Fig. 6—A Resistant Plant of Cotton in a Badly Diseased Area. Original.

their cotton. By continuing this process year after year the cotton may be improved to a certain extent. Our experiments and others show though, that mass selection is a very poor way to secure a resistant strain of cotton, and that even when working for yield alone, individual selection is the better method to use.

In individual selection the best and most resistant plants are picked, and the seed of each plant saved by itself. The next season a short row is planted from each stalk. The rows are planted side by side and this gives a good opportunity for comparing the progeny from the different stalks, and finding out which selection has the strongest transmitting power. This is an important point to determine, for it has been found that plants like animals vary greatly in their power to transmit certain qualities to their progeny.

As an illustration of this variation in different selections let us notice in a brief way the behavior of a few selections, those from the Russell and Excelsior. In 1905 ten plants of the Russell, and one plant of the Excelsior cotton were selected, all of which seemed to be more or less resistant to the disease. The seed from these different selections were planted in 1906 with the following result:

RUSSELL.		EXCELSIOR.	
Selection No.	Per cent. dead.	Selection No.	Per cent. dead.
1 .....	35	1 .....	16
2 .....	20		
3 .....	42		
4 .....	65		
5 .....	76		
6 .....	80		
7 .....	51		
8 .....	56		
9 .....	70		
10 .....	74		

The Excelsior selection being so resistant, seed from the whole row except from the stunted stalks, were saved for planting the next season. The Excelsior selection has maintained the resistant quality up to date, in 1908 only 9 per cent. of this cotton dying from the black root disease. Fig. 7 shows the comparative resistance of this selection with two rows from unselected Excelsior seed.



Fig. 7.—Result of Planting Seed from Selected Stalks: On left, one row from selected stalk of Excelsior; On right, two rows from unselected seed of Excelsior. Photograph taken Oct. 12, 1906, Vienna, Ga. Original.

In 1906 all the Russell selections were discarded, except Nos. 1, 2, and 3, as over 50 per cent. of the others died. In 1908 only selection No. 2 was saved for planting the next season. The Russell cotton shows how difficult it is going to be to get a resistant strain of this variety, and the Excelsior how easy it may be to secure a resistant strain of cotton.

Many other varieties of cotton have been taken up in the same way as the Russell and Excelsior, but as to take each up in detail would make too long a report, we will give the results in a general way.

### RESULTS FROM SELECTING RESISTANT PLANTS.

In 1905, 77 different selections were made from 9 different varieties of cotton. In 1906, the progeny of only 11 of these selections were considered worthy of further testing. In 1907, the progeny from only four of these were saved, and in 1908 only two of these were saved for future planting. One of these two strains was very resistant and prolific, and will be propagated next summer, 1909, for distribution the following spring. Thus it will be seen that from the 77 selections made in 1905 we now have one and maybe two resistant strains of cotton.

In 1906, at Vienna, Georgia, 48 different selections were made from 8 varieties of cotton. In 1907 the progeny from 8 of these selections were saved; and in 1908 only three of these were saved for planting the next season. Only one of these selections is resistant enough to propagate for distribution, the other two will have to be improved still more by farther selection before they will be resistant enough to grow for distribution.

From the above it will be seen that it is no small task to secure a resistant strain of cotton, when it requires in some cases careful selection for several years to secure the desired result. Then, too, it must be remembered that even if the first year one secures a selection that is resistant, as in the case of the Excelsior, one stalk of cotton must be propagated for three years before much seed can be secured.

### HYBRIDIZING EXPERIMENTS.

#### (CROSSING VARIETIES.)

In 1905 several varieties of cotton were crossed with the Dillon to see if in this way we could not secure a strain of cotton with long or short limbs, that would have the great resistance of the Dillon. While it is yet too early to make a detailed report upon the different hybrids, some of them will be mentioned in a brief way.

In 1905 an extra good and hardy stalk of the Russell cotton was found in our field at Zellobee, Georgia. Several blooms on this stalk were properly prepared and pollenized with pollen from a good stalk

of the Dillon cotton. The hybrids we now have from this cross are quite resistant and very prolific. We are now selecting to obtain a uniform type for this hybrid. The type of cotton we are selecting from this hybrid is shown in Fig. 8.



Fig. 8—Hybrid Stalk of Cotton. Russell  
Crossed with Dillon. Original

In 1905 a number of crosses were made with King's Improved and the Dillon cotton. We now have a hybrid from one of these crosses that is very promising. In Fig. 9, the comparative resistance of this cotton, Hybrid No. 55-1-5, with the Culpepper is well shown. We have just sent out some seed of this hybrid, though the type is not yet well fixed. Next summer, 1909, we are planning to plant one acre of this cotton, then in spring of 1910 we will have a quantity of seed for distribution.

From the results thus far secured we believe this phase of the work, hybridizing, gives promise of securing some valuable results. Up to date 15 varieties of cotton have been crossed with the Dillon, and from some of these we hope to secure a strain of cotton still better than the ones mentioned above.



Fig. 9—Shows Comparative Resistance of Hybrid with Culpepper Cotton. Two rows on left Hybrid No. 55-1-5; two rows in center Culpepper. Original.

#### DISTRIBUTION OF RESISTANT COTTON SEED.

The object of the work and experiments on black root is two fold: 1st. To secure strains of cotton that are resistant to the disease; 2nd. To propagate these resistant strains of cotton and distribute the seed to the cotton growers who have to contend with the disease. On account of its taking several years to get this kind of work well started we have not as yet had any great amount of seed for distribution. In 1906 seed were sent to 20 different farmers, in 1907 to 81, in 1908 to 89, and in 1909 to 125, making a total of 315. In each case enough seed were sent to each party to plant from one to two acres.

The importance of this phase of the work is at once apparent to all. It enables us to determine from personal inspection of many of the fields, and from the reports received, whether the cotton is resistant or not and how it yields, in different sections of the State. The farmer, though he only gets enough seed to plant an acre or two, can from this start soon have enough seed to plant his whole farm in this strain of cotton, if he so desires.

## PLAN OF FUTURE WORK.

Arrangements have now been made to carry on the work this season, 1909, on a larger scale than heretofore, and next winter we hope to have over 100 bushels of resistant cotton seed for distribution. We will also grow in summer of 1909 several acres of the Iron cowpea, then in spring of 1910 we will be able to distribute a limited quantity of seed of this valuable cowpea. The work on selection and hybridizing will be continued as heretofore. The main effort will be to still further improve the resistance of the strains we have already secured. At the same time an effort will also be made to secure an increase in the yield of these resistant strains of cotton. Other varieties will be tested and an effort will be made to obtain a strain of cotton that will be resistant to the nematodes and the black root disease of cotton. We are also trying to secure a resistant strain of cotton that will yield a very high per cent. of lint. In 100 selections last year the yield of lint ran from 18 per cent. to 43 per cent. The coming season the progeny from the selection yielding 43 per cent. of lint will be watched with a great deal of interest. All of our selections that do not yield 33½ per cent. of lint are discarded, even though they are resistant, as we do not believe that the farmer as yet wants to raise cotton for the seed.

That dreaded enemy of cotton, the Mexican Cotton Boll Weevil, is not in Georgia yet, but it is coming at the rate of 50 to 75 miles a year, and may reach here in three or four years. The best way to fight this insect is by certain cultural methods and the planting of a very early variety of cotton. By referring to the list of the different varieties of cotton tested for resistance to black root on page 10, it will be seen that 87 per cent. of King's Early died from the disease. This is the variety that has been used so successfully in Texas in fighting the boll weevil. Hence an effort is going to be made to secure a resistant strain of cotton from this or some other early variety of cotton, so as to be prepared in a measure for the boll weevil when it arrives in the State.

It may be well to state here for the information of those who may receive this bulletin that we now have no resistant cotton seed for distribution, our supply for this spring, 1909, being exhausted. Requests for seed may be sent in at any time. All such requests will be placed on file, and filled in spring of 1910, in the order received, as long as the supply of seed lasts.

## SUMMARY OF REPORTS FROM INDIVIDUAL PLANTERS WHO HAVE TESTED THE RESISTANT COTTON.

As mentioned on page 20, we have already sent seed of the resistant cotton to 315 planters who have the disease on their farms. Each season a number of these fields have been inspected, and from the

most of the others reports have been received. In the following paragraph some of these reports will be given in brief, to show what the results of the tests have been in different sections of the State.

Col. M. B. Council, Americus, Georgia, reported that "None of the Dillon cotton died, except in a spot where there had been a watermelon patch the year before, and that 80 per cent. of the adjoining cotton died from the black root disease." The reason for the cotton dying where the watermelons had been was that they had increased the number of nematodes in the soil.

Hon. C. C. Richardson, Byron, Georgia, reported that but very little of the Dixie cotton died, where the year before over 75 per cent. of the cotton died.

Mr. J. Q. Hall, Sandersville, Georgia, reported that but from one to five per cent. of the Dillon cotton, and 50 per cent. of the adjoining cotton died from the disease. The Dillon yielded 1,000 pounds of seed cotton per acre, other cotton only 750 pounds per acre.

Mr. Oscar Aycock, Shellman, Georgia, reported that 10 per cent. of the Dixie cotton died, and 50 per cent. of Truitt. The Dixie yielded 900 pounds, Peterkin 1000 pounds, and Truitt 600 pounds of seed cotton per acre.

Mr. S. S. Sauls, Shellman, Georgia, reported that 5 per cent. of the Dixie and 50 per cent. of the adjoining cotton died. The Dixie yielded 1,600 pounds of seed cotton per acre, Hawkins 1,080 pounds per acre.

Mr. George May, Warthen, Georgia, reported that 5 per cent. of the Dillon and 25 per cent. of the adjoining cotton died. Yield of Dixie 1,200 pounds of seed cotton per acre, yield of other cotton not given.

Mr. O. A. Bozeman, Ashburn, Georgia, reported that very little of the Dixie cotton died. Yield of Dixie was 2,260 pounds on 3,480 square yards, less than an acre; yield of Russell was 1,350 pounds per acre. Both received the same amount of fertilizer, 600 pounds of a 9-2-4 home mixed guano.

Many other reports similar to these could be given, but these show how the resistant strains of cotton compare with the other varieties of cotton when grown on diseased land.

Of the many fields that have been visited in the last three years where our cotton seed were planted only two fields were found that died to any great extent. One of these fields was planted after corn and the Unknown cowpea, the other was planted in very loose and sandy soil. An inspection of the cotton roots showed that the cotton was badly infested with the nematode worms. All of our experiments and observations go to show that if the nematodes are not too numerous the resistant strains of cotton will make a fair yield on land badly infected with the black root fungus.

## SUMMARY AND RECOMMENDATIONS

"Black root" disease of cotton is due to a fungus that attacks the roots and stems of the plants, and by its presence in the water ducts of the plant cuts off the food supply thereby stunting or killing the plants attacked.

The fungus lives during the winter in the soil in the decaying cotton roots and stems and probably also in the form of spores in the soil.

The disease may be spread from one field to another by animals carrying the infected soil on their feet, or by running water washing the soil into an uninfected field. For this reason cattle should not be allowed to roam over infected fields, and the washing of the soil from an infected field into adjoining fields should be prevented if possible.

The disease may also be spread on tools, such as plows and cultivators. One way to avoid this is to use separate tools for this piece of land; or else the tools used in the diseased field should be washed with a disinfectant before using them in another field. Corrosive sublimate 1 part to 1,000 parts water, or a 4 per cent. formalin solution may be used as a disinfectant.

Frequently a small but badly infected area is found in the middle or at one side of a field; in such places it may be well to throw the infected area out of cultivation for three or four years or plant the whole field in some crop not affected by the fungus.

The disease can not be controlled by the application even in large quantities of fungicides, such as Bordeaux mixture, copper carbonate, copper sulphate, sulphur, lime and sulphur, formalin, and tobacco dust.

Experiments covering four seasons indicate that the disease can not be controlled by the use or disuse of commercial fertilizers or by the application of large amounts of lime or tobacco dust to the soil.

Date of planting whether early or late, has but very little if any effect, in reducing the severity of the disease. Late planting is objectionable on account of the reduction in yield.

Variety tests of cotton have shown that while the different varieties vary greatly in their susceptibility to the black root disease, none that we have tested, except the resistant strains mentioned below, are resistant enough to plant on diseased land.

The Dillon and Dixie cottons originated by Prof. W. A. Orton, and three of our strains which we have not yet named, are quite resistant to the black root disease of cotton. On diseased land no other varieties of cotton than these should be planted.

Rotation of crops is advisable in order to reduce the black root fungus. If the land is infested with the nematodes, and most of the sandy land in South Georgia is more or less infested, it should be planted for at least one or two, or better, three years in some crop or crops which will not increase the number of nematodes in the soil. After

this rotation the land may be planted in a resistant strain of cotton and very little of the cotton will die and a good yield may be secured.

In the rotation any of the following crops may be used as they will not support the fungus or the nematodes; corn, oats, wheat, rye, iron cowpea, velvet bean, peanut, and hairy vetch.

Parties receiving resistant cotton seed from the State Board of Entomology or elsewhere should be very careful to keep it pure. If this is not done the cotton will not maintain for many years the resistant quality. To keep the cotton resistant care should be exercised to see that no seed is saved from stunted plants. To avoid this go over the field once or twice before the first picking and pull up all stunted plants. To avoid mixing the seed at the gin, save the resistant cotton until it is all gathered, except the top crop, before taking it to the gin. Before running it through the gin see to it that all seed are removed from the breast of the gin, and let the seed drop out on the floor, or better, on a sheet. It will pay to do this even if you have to pay more to get the cotton ginned.

Our experience and the experience of investigators in other states goes to show that the cotton grower of to-day, in order to raise cotton successfully and profitably, must practice rotation of crops and the selection of seed.





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# Georgia State Board of Entomology

BULLETIN NO. 29

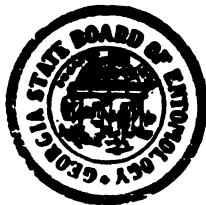
MARCH 15, 1909

## The Codling Moth or "Apple Worm" in Georgia

STATE CAPITOL

ATLANTA, GA.

By  
W. V. REED  
Assistant Entomologist





# **GEORGIA STATE BOARD OF ENTOMOLOGY.**

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The investigations on Codling Moth outlined in this publication have been conducted by Mr. W. V. Reed under the direction of the State Entomologist. This work will not be completed until it has been conducted through another season, but it is thought best to publish results thus far obtained in order that apple growers may make practical use of same.

E. L. WORSHAM,  
State Entomologist.

Atlanta, Ga., March 15, 1909.

## PART I.

Life history work, together with experimental sprayings with arsenicals looking to the best control of the codling moth in the State, was begun in the spring of 1906 and has been conducted yearly since. Very meagre success attended the investigation during 1906 and 1907, owing to the unfavorable location (in regard to late frosts) of the orchard in which the spraying feature of the work was carried on. The weather conditions as a whole during the spring seasons of both 1906 and 1907 were abnormal, frost occurring as late as the latter part of April. The early spring weather had been such as to start the trees to growing rapidly and, consequently, the fruit was in just the shape to be most susceptible to cold weather.

The season of 1908 was favorable for the work in every respect for making a careful study of the life history of the moth and testing the experimental spray outline. The outline was carefully followed with very gratifying results. It is hoped that the practical information obtained will give further impetus to the apple growing industry of this State, a resource now being developed. This industry is of prime importance to the people of the northern part of the State, a section particularly well adapted to apples. Some of our native apples are as fine in quality as are grown anywhere in the United States.

We wish to express our indebtedness to Col. O. B. Stevens and Mr. S. R. Christie of Cornella, Ga.; Wayman and Riegel of Pomona, Ga.; and Mr. J. H. Davis of Tallapoosa, Ga., for placing their orchards at our disposal for experimental work and otherwise rendering valuable aid in sundry ways.

### LIFE HISTORY.

Extensive literature has been published by the Northern and Western States of the Union covering the codling moth problem as presented in those particular sections, but in order to combat an insect pest successfully and economically, it is of prime importance that we understand thoroughly its life history in that section. Very often, owing to varying climatic conditions within the borders of a single State, an insect's life history varies so much that what is true in one section needs to be verified in another before the information gathered in any one particular section of the State can be taken advantage of in any other section. Especially is this true concerning certain stages of the life history of the codling moth, for in that particular

stage from the time the eggs hatch until the larvae enter the fruit, we find it more vulnerable to preventive measures.

Naturally, with no accurate knowledge of the insect's life history in this latitude, sprayings for this pest in a great many cases have not been followed by the best results, owing to the guess-work involved as to when the sprayings should be made. In the present detailed study of the moth's life history, care was taken to have all the observations made under normal conditions.

Outdoor breeding cages, together with glass jars and vials, were used in the life history work. The glass jars and vials were covered with gauze cloth held in place by rubber bands, and were placed outside or near an open window, in order that conditions would be as nearly normal as possible. At the same time results were checked daily by observations in the orchard.



Fig. 1—Adult codling moth.

**Hibernation.** The codling moth hibernates during the winter in the larval stage in cocoons. At the approach of warm weather in early spring the grubs change to pupae and later come forth as adults. (Fig. 1). The time of emergence of the hibernating moths depends entirely upon the season. No more exact barometer of the emergence of the first hibernating moths can be given than a week to ten days after the petals of the apple blossoms fall. During our three years' observation on this point the emergence of the moths has not varied in the least in this respect, although the seasons or blooming periods have varied as much as three weeks. In the following table we give the dates of emergence of the hibernating moths for the last three years:

AT CORNELIA (1906)	AT POMONA (1907)	AT TALLAPOOSA (1908)
May 6 - 1 adult emerged	April 25 - 1 adult emerged	April 9 - 8 adults emerged
May 7 - 2 adults emerged	April 27 - 4 adults emerged	April 10 - 2 adults emerged
May 10 - 1 adult emerged	May 2 - 1 adult emerged	April 12 - 2 adults emerged
May 12 - 4 adults emerged	May 9 - 2 adults emerged	April 13 - 1 adult emerged
May 15 - 1 adult emerged	May 10 - 2 adults emerged	April 15 - 2 adults emerged
May 22 - 3 adults emerged	May 14 - 3 adults emerged	April 17 - 1 adult emerged
May 24 - 2 adults emerged	May 17 - 1 adult emerged	April 19 - 1 adult emerged
		April 20 - 1 adult emerged
		April 21 - 3 adults emerged
		April 26 - 1 adult emerged

It is seen that the emergence of the hibernating moths generally varies from year to year; in fact, their emergence is controlled en-

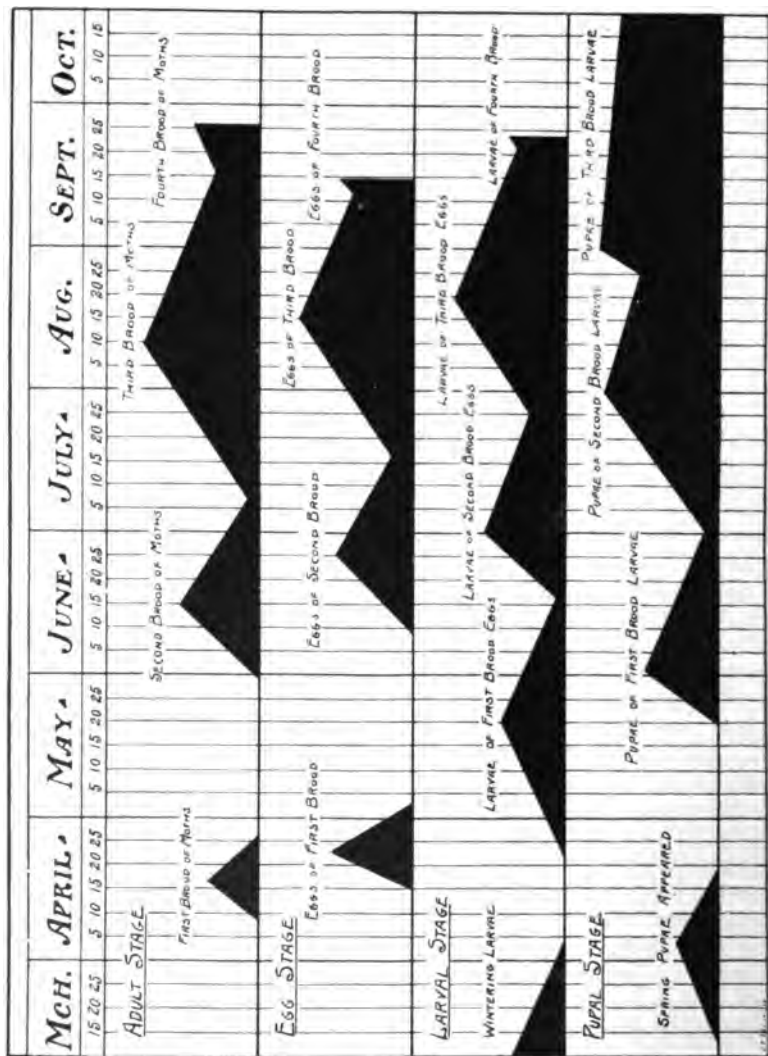
tirely by the temperature and each year's observation shows that they begin to emerge in a week to ten days after the petals begin to fall from the apple blossoms. Luckily, the same conditions that influence the growth of the apple tree in early spring affect the development of the hibernating insect, thereby making it possible for the orchardist to have some unerring sign in the condition of his apple tree to warn him of the approach of the most serious apple pest.



Fig. 2—Egg of the codling moth, greatly enlarged.

**Eggs.** The hibernating moths, four or five days after emerging, lay their first eggs. (Fig. 2). The eggs are about the size of an ordinary pin-head, pearly white in color when freshly laid and remind one of tiny fish scales when observed in bright sunlight. In the course of two to three days a red ring appears near the apex of the eggs, and as they near maturity the red ring broadens and assumes a darker color, until almost the entire apex is covered. This darkened area is the embryonic larva and before emerging the dark head and cervical shield are distinctly visible, as is also the body of the larva when the egg is held towards the light. The embryonic larva is placed in the eggs in a circular position, the head almost touching the caudal segments of the body.

The young larva on becoming perfectly developed makes its exit from the egg by means of its comparatively powerful jaws, normally by cutting a transverse slit in the shell near the base of the egg, large enough to admit passage of its body. The larva, by moving its head slightly from side to side, enlarges the opening by means of its jaws sufficiently to admit the passage of its head and then by successive efforts, extracts its body. Sometimes, in case the eggs have been deposited in pits or upon irregular surfaces, the larvae experience



Life history chart for 1908.

much difficulty in making their exit. Frequently changing its position the larva generally prys the egg loose at some point in its vain effort to use its mandibles or jaws, and crawls forth.

By far the largest percentage of the eggs is deposited on the upper surfaces of the leaves. Accurately speaking, eighty-six per cent. plus, against nine per cent. plus on the fruit, three per cent. plus on the lower surfaces of the leaves, and less than one per cent. on the twigs. As a rule eggs are deposited on the leaf clusters near an apple. Occasionally, however, you find them several feet from an apple and even on foliage of trees that have no fruit.

An accurate record of all eggs observed, and the place of deposit, from June 9th to July 16th, is given in the following table:

Upper Surface of Leaf	Lower Surface of Leaf	On Fruit	On Twig	Parasitised	Total
832	32	92	8	184	964

In view of the fact that when the moths were confined we could seldom get them to deposit eggs, no accurate data could be obtained on the number of eggs that they laid. It has been stated that they are capable of laying fifty eggs. In one instance recorded in our notes, a moth placed in a vial one afternoon, remaining there over night and up until an early hour the following day, deposited eight eggs. At that rate a short existence of the adult moth would insure the probable fifty eggs that it has been stated they are capable of laying.

The moths undoubtedly deposit the majority of their eggs late in the evening when they are observed frequenting the apple trees. Only in one instance was a moth observed depositing an egg, and that was one cloudy evening near night.

Length of the egg stage varies from eight to ten days in the early spring. In midsummer during July the eggs hatch in five or six days. By consulting table on page 7 it will be seen that the average length of the egg stage for those laid in early spring and in midsummer is nine and a fraction days, and five and one-half days respectively, or an average length of seven and a fraction days for the season. In the majority of instances the length of the egg periods given in the table is only approximately correct. As before stated it was extremely difficult to get the moths, when confined, to deposit eggs. Enough were observed correctly, however, for us to estimate the age of the eggs by the appearance of the red ring. It was found that the red ring appeared in the course of two or three days after the eggs were deposited, and on collecting eggs the age was approximated when the red rings appeared, allowing three days in early spring and two later on in the season as the time elapsing since they were laid.

Eggs deposited		Eggs hatched		Total time
April	15, 1908	April	24, 1908	9 days
"	15 "	"	25 "	10 "
"	16 "	"	26 "	10 "
"	17 "	"	25 "	8 "
"	20 "	"	28 "	8 "
"	20 "	"	28 "	8 "
"	20 "	"	30 "	10 "
"	21 "	"	30 "	9 "
"	21 "	"	30 "	9 "
"	29 "	May	9 "	10 "
May	2 "	"	11 "	9 "
"	3 "	"	13 "	10 "

Average length of egg stage in early spring, 9.16 days.

June	16, 1908	June	22, 1908	6 days
"	16 "	"	21 "	5 "
"	16 "	"	22 "	6 "
"	17 "	"	22 "	5 "
"	17 "	"	23 "	6 "
"	19 "	"	24 "	5 "
"	19 "	"	24 "	5 "
"	19 "	"	24 "	5 "
"	24 "	"	30 "	6 "
"	25 "	July	1 "	6 "
"	25 "	"	1 "	6 "
"	28 "	"	3 "	5 "

Average length of egg stage in mid-summer, 5.5 days.

General average for one season, 7.3 days.

**Larva.** The newly hatched larva is about one-twelfth of an inch in length, white in color, except the head and cervical shield which are black. The color soon changes to a pinkish tint. The body is dotted regularly with tubercles, each containing a short hair or seta. On emerging from the egg the larva is very active, and when it is on the fruit it searches constantly for some irregularity on the apple at which to enter, and, for that reason, we find it as a rule entering the calyx end, less commonly at the stem end, on the sides, where two apples touch, or where an apple is touched by a leaf or twig. The larva is not exactly born hungry and fully fifteen to thirty minutes pass before it attempts to feed if it at once locates itself favorably. Not infrequently we find the larva feeding several days in the calyx cavity before it attempts to burrow into the fruit.



Fig. 3—Leaf showing feeding area of the codling moth larvae.

Larvae hatching from eggs placed on leaves at once begin to search for the fruit. It is doubtful if those placed some distance from fruit ever succeed in finding an apple and for those located on leaves in close proximity to fruit a variable time will elapse if they are successful, and in order to subsist, they feed on the foliage. At first they may bore into the midrib or through the leaf, later they feed by skeletonizing small areas on the surface of the leaf. (See Fig. 3). The characteristic feeding areas of the larvae on the foliage are always very small, seldom one-half inch in diameter. They frequently change from place to place while feeding on the foliage, and the inference is that when hunger does not besiege them they search for more tempting food, the apple.

We have succeeded in rearing larvae and obtaining adult moths from a leaf diet entirely. Whether this occurs normally is doubtful, but the fact that young larvae feed on the foliage several days and then find an apple, is a frequent occurrence. We have observed the larvae apparently a fourth grown in size, in the orchard feeding on the foliage. While feeding on the foliage they guard against their enemies by spinning over themselves a more or less web-like structure made from excrement and silken threads.

Entering the fruit. The young larvae, as stated before, like a protected nook or place that admits of secure lodging to begin feeding, and for that reason probably the calyx end of an apple is generally entered, and less often the stem end and sides. An accurate record of all apples on five trees, as tabulated below, shows the relative percentage of larvae entering the calyx, side and stem end respectively, for the entire season. Windfall apples, until they were of value, were

cut open and examined for larvae so as to get some idea of the percentage of larvae that remained in the fruit after it had fallen. Beginning May 4th, windfalls were picked up and examined every seven days until August 24th, when ten days were allowed to elapse between pickings until apples were gathered on September 28th. The windfall apples were of sufficient size by August 11th to be of value to the owner and the opening of the apples was discontinued.

RECORD OF APPLES ON FIVE TREES.

Tree No.	Total No. of Apples	Sound	WORMS ENTERING.			Total Wormy	Larvae
			Calyx	Side	Stem		
Tree 1	5772	4522	920	221	109	1250	57
Tree 2	3562	2877	504	118	63	685	28
Tree 3	3091	2419	506	114	52	672	32
Tree 4	3257	2566	534	102	55	691	24
Tree 5	2563	1941	467	96	59	622	18
Totals	18245	14325	2931	651	338	3920	150
"	in per cent.	78%	16%	3%	1%	21%	less than 1%
Infestations occurring through			74%	16%	8%		

The table shows in round numbers that 74 per cent. of all infestations occurred through the calyx end and only 16 per cent. and 8 per cent., respectively, through the sides and stem end. No appreciable difference in the relative percentage of infestations through the calyx end, as compared to the side and stem end, was noticeable at any time during the season. They were markedly uniform. The prevalent idea that more infestations occur through the side as the season advances is erroneous, as the results show.

**Characteristic entrance of the larvae.** Infested apples are readily recognized by a mass of brown borings and excrement entangled in silken threads at the entrance to their burrows. (Fig. 4.) As they tunnel towards the core, their objective point apparently, they push their borings and excrement to the surface and there they adhere entangled in silken threads. Late in the season the larvae more seriously disfigure the fruit by feeding near the surface some time before boring inward. Areas from one-half to an inch in diameter are mined under and thus make what are known as "wormy spots," very noticeable and consequently deprecate the value of the fruit.

**Time spent in the fruit.** The time spent by the larvae in the fruit is exceedingly variable. From thirteen observations on the first brood of larvae the time varied from seventeen to forty-one days or an average of about four weeks. From forty-five observations made during July, the time varied from thirteen to thirty-six days or an average of less than three weeks. From the fifty-eight observations made dur-



Fig. 4—Wormy apples, showing the characteristic mass of brown particles at points of entrance of codling moth larvae.

ing the season, we would have an average of about twenty-four days that the larvae remain in the fruit. In general, it may be stated that the first brood spends from seven days to two weeks more time in the fruit than later broods, except part of the season's last brood, which may remain equally as long owing to climatic conditions.

Some observations on the length of the larval stage tabulated were as follows:

Larvae emerge from eggs and enter fruit	Larvae enter cocoons	Total time
April 23, 1908	May 22, 1908	29 days
" 23 "	" 23 "	30 "
" 24 "	" 20 "	26 "
" 25 "	" 23 "	28 "
" 25 "	" 22 "	27 "
" 26 "	" 27 "	31 "
" 26 "	" 26 "	30 "
" 27 "	" 22 "	25 "
" 27 "	June 4 "	38 "

TABLE—Continued.

Larvae emerge from eggs and enter fruit.	Larvae enter cocoons	Total time
April 27, 1908	June 2, 1908	36 days
" 30 "	" 10 "	41 "
May 2 "	May 29 "	27 "
" 11 "	" 28 "	17 "
June 8 "	June 26 "	18 "
" 12 "	July 1 "	19 "
" 13 "	" 4 "	21 "
" 17 "	" 8 "	21 "
" 17 "	" 10 "	23 "
" 17 "	" 11 "	24 "
" 18 "	" 11 "	23 "
" 18 "	" 5 "	17 "
" 18 "	" 11 "	23 "
" 18 "	" 4 "	16 "
" 18 "	" 4 "	16 "
" 18 "	" 8 "	20 "
" 18 "	" 7 "	19 "
" 19 "	" 12 "	23 "
" 19 "	" 7 "	18 "
" 19 "	" 16 "	27 "
" 19 "	" 5 "	16 "
" 19 "	" 4 "	15 "
" 19 "	" 13 "	24 "
" 20 "	" 12 "	22 "
" 20 "	" 11 "	21 "
" 20 "	" 7 "	17 "
" 21 "	" 27 "	36 "
" 21 "	" 11 "	20 "
" 21 "	" 7 "	16 "
" 21 "	" 8 "	17 "
" 21 "	" 9 "	18 "
" 21 "	" 6 "	15 "
" 21 "	" 13 "	22 "
" 22 "	" 6 "	14 "
" 22 "	" 7 "	15 "
" 22 "	" 9 "	17 "
" 22 "	" 10 "	18 "
" 23 "	" 8 "	15 "
" 23 "	" 23 "	30 "
" 24 "	" 9 "	15 "

TABLE—Continued.

Larvae emerge from eggs and enter fruit.		Larvae enter cocoons		Total time
June	24, 1908	July	7, 1908	13 days
"	24 "	"	7 "	13 "
"	24 "	"	7 "	13 "
"	24 "	"	7 "	13 "
"	24 "	"	8 "	14 "
"	25 "	"	10 "	15 "
"	30 "	"	19 "	19 "
July	1 "	"	22 "	21 "
"	3 "	"	20 "	17 "



Fig. 5—Interior of wormy apple showing full grown larva and excavation to and around the core.

**Appearance of the full grown larva.** A full grown larva (Fig. 5), usually measures about three-fourths of an inch in length and has a pinkish or flesh color. The characteristic color is sometimes acquired by half-grown larvae. The black head and cervical shield, so noticeable when the larva is young, change to a brown color.

**Preparation for leaving the fruit.** Before the larvae become full grown they make careful preparations for leaving the fruit. In entering, their objective point is always the core, and there they feed on and around the seed of which they are very fond. Several days before they actually wish to leave they eat a passage way, usually the shortest, to the exterior, or re-traverse their entrance tunnel. When near the surface they may remain for several days feeding and making further preparations for leaving the fruit forever.

**Are two or more apples entered by a single larva?** When two apples touch, as they very often do, a single larva may infest both apples, but in one instance the author observed a larva make its exit from an apple and enter another six inches or more away while the apples were still on the tree. Therefore, in rare instances it may be stated that two apples are entered by a single larva even when they do not touch, but on account, presumably, of the first quarters becoming water-soaked, as we have found larvae dead in their burrows apparently overcome by the sticky liquid in the channel in trying to make their way out, or drowned outright at the furthestmost end of their tunnels. Two larvae are very seldom actually found feeding in the same apple, though apples apparently doubly infested are frequently observed. In a great many cases so noted, one larva has made two infestations, feeding in one burrow for some time and then coming out and re-entering at some other point for no obvious reason unless it is on account of the first burrow becoming water-soaked.

**Manner of leaving the fruit.** When ready to leave, the larvae push the plug from their already prepared exit hole and immediately seek a place to spin their cocoons and enter the pupal stage. In most cases, if the apple is upon the tree, the larvae will crawl from the apple to the twig and then by way of the branch to the trunk, where under the rough, loose bark and in crevices a great many pupate, or else continue down the trunk and from there until a suitable place is found. Another method sometimes employed, or happens more often accidentally perhaps, is that in which the larva lets itself down by a silken thread to the ground. The exact proportion that drops to the ground or falls with the fruit and ascends the trunk in search of a pupating place is forty per cent., as compared to sixty per cent. that crawls down the trunk.

The results above quoted were obtained by placing three bands around a number of trees, the middle band being dipped in tar, thus preventing the larvae from passing that band in either direction, and a record kept of all larvae caught under the two remaining bands. The majority of larvae that we could keep record of, crawl down the trunk of the tree, though the probability is that only a few of those that drop to the ground in the apples or by means of silken threads ascend the trunk of the tree to pupate.

**Place of spinning cocoons.** Normally in orchards cocoons are most readily found under rough, loose bark and in the crevices on the trunks of apple trees. Decayed limbs or hollow cavities are favorable places for the larvae to make their cocoons. We have found larvae pupating within their burrows in apples and also under rubbish beneath the trees. In general almost any place that will afford protection from the weather, such as a fence or under the shingles and in the crevices of an old house, is a likely place to find them.

If the worms are carried in apples into the store room they will spin their cocoons in cracks in the floor and wall, under trash, beneath the hoops of barrels, and in the corners and crevices of boxes and bins, and wherever suitable protection is found. The author found as many as twenty securely hidden under one hoop. Apple storage houses constitute an important source of infestation in the spring and should receive the attention of the orchardist, as is treated more fully elsewhere.



Fig. 6—Cocoons as they appeared beneath the hoop of a barrel in apple storage cellar, natural size.

**Appearance of the cocoons.** The cocoons (Fig. 6) are made to fit the crevices the larvae crawl into to pupate, and their exteriors assume various shapes. The inside is always symmetrical and lined with a layer of smooth white silk, and the outside is more roughly made with silk and bits of particles removed by the larva in hollowing out a cavity for its body, with its jaws. If the larvae are removed from the cocoons before having changed to pupae, they will at once find a suitable place and make another. In fact sometimes the larvae, and especially the hibernating larvae, will leave their first cocoons and make others, probably on account of their first quarters becoming damp, or else they were made so securely that it would endanger the moth's life in emerging. It is apparent that cocoons made late in the season, in which the larvae wish to pass the winter, are much thicker and more securely made than those made by other broods.

**Duration of the cocoon stage.** The larvae, after making their cocoons do not, as a rule, at once change to the pupal stage; more variations occur in this respect than any other phase of the moth's life

history. The winter is always passed by the larvae in cocoons and not until some time in the spring do we find them changing into the pupal stage proper, or after the lapse of seven or eight months, normally. From a record kept of twenty larvae of the first brood, after leaving the fruit, we find the actual time the larvae remained in the cocoons as such, varied from two to thirteen days, and one of the larvae has not yet changed to pupa, and evidently will pass the winter before it does. The total time spent in the cocoon as a larva and pupa varied from eight to twenty-five days, or an average of a little over fourteen days. At no time during the season did the adults emerge after the larvae entered the cocoons in less than a week's time.

TABLE SHOWING LENGTH OF COCOON STAGE.

Larvae enter cocoons	Change to pupae	Emerge as adults	time Total
May 20	May 28	June 2	18 days
" 21	June 3	" 14	14 "
" 22	May 25	" 2	11 "
" 22	" 27	" 25	14 "
" 22	" 28	" 7	16 "
" 22	" 26	" 4	13 "
" 23	" 31	" 12	20 "
" 23	" 25	" 5	13 "
" 23	" 25	May 31	8 "
" 23	Larva still in cocoon.		
" 24	" 26	June 6	13 "
" 24	" 28	" 4	11 "
" 27	" 30	" 9	13 "
" 28	" 30	" 12	15 "
" 28	" 30	" 22	25 "
" 29	June 1	" 12	14 "
June 2	" 9	" 20	18 "
" 4	" 7	" 17	13 "
" 6	" 9	" 20	14 "
" 10	" 12	" 21	11 "

**Emergence of the adult insect.** The pupa, by means of spines on its abdominal segments, works itself partially out of the cocoon, and then the pupal skin splits down the back and the adult moth forces itself out. A few seconds elapse before the newly emerged moth gains full use of its wings, during which time it generally crawls rapidly from place to place. After the wings of the moth become fully expanded it takes its first flight, and is soon lost to view by its quick, erratic movements so characteristic of the family of which it is a member.

**Appearance of the adult or moth.** The adult codling moth (Fig. 1) has a wing expanse of one-half to three-fourths of an inch. Extending from its body its front wings are covered with grey intermixed with narrow, wavy lines of brown scales, and near the tip of each wing is a spot known as an ocellus, of brown and metallic colored scales, and along the border of each wing is a delicate fringe of scales. The moth when at rest folds its wings over its body and its general appearance is such as to harmonize with its surroundings and is not readily distinguished from the gray bark of the apple trees upon which it rests.

The males and females are easily distinguished. The male has an elongated, blackish spot on the lower surface of the front wing, and is distinguished from the female by a narrow pencil of black hairs on the upper surface of the hind wing.

**Habits of the moth.** The moths are nocturnal in their habits, resting during the day on the foliage in the shady recesses of some apple tree, and only venture forth late in the afternoon or on very cloudy days, unless disturbed. As the evening shadows begin to fall, they are particularly alert and by their characteristic flight they are at once recognized as they circle around the apple trees and settle down from time to time on the foliage. While conducting this investigation at least thirty moths must have been seen circling and darting among the outer limbs of a large apple tree. As the evening shadows begin to fade away the moths become less numerous. While spraying trees during the middle of the day we have very often disturbed the moths, and have seen them settle again on the upper surfaces of leaves exposed to the sunlight, but they always remain inactive.

The moth is capable of taking food by means of a slender, pointed tongue, and is supposed to feed upon sweet substances. We have observed them sip the juice from bruised apples, but in no known way can they be drawn in numbers to feed on any substance and trapped. They are also not attracted by light to any great extent, but we have taken a few around lights.

**Length of life of the moth.** On an average when confined they live less than a week. In one instance in a breeding cage where the dirt in the bottom of the cage was kept moist and a portion of fresh apple supplied every few days, one moth out of a number placed in a cage lived twenty-five days. The majority died inside of ten days. In a large cage enclosing a small apple tree and admitting of normal outside conditions the moths seldom lived two weeks. We would conclude from the foregoing that the moths are short-lived, two or three weeks at the outside, marking their average existence normally.

The average length of the respective stages of the insect's life given in the foregoing, is, for the egg, seven days; the larvae, twenty-one days; the pupae, fifteen days; and with five days intervening as the probable time from emergencies of the moth until egg laying begins,

there is a total of forty-eight days. Records of the total time in the life cycle of individual moths varies from thirty-five to sixty-five days, but in general it may be said that approximately seven weeks are required.

**Number of generations or broods.** In this latitude there are three and a part of a fourth generation. On page 18 in chart form we give the time of occurrence and number of generations for 1908. It should be remembered that the spring season for that year opened extremely early and gave the moth in proportion a longer active existence. Some years it is probable that the generations will not exceed two and a part of a third. In fact, our somewhat imperfect observations during the latter part of seasons 1906 and 1907, though not given as implicitly reliable, owing to the interference of transient work late in the season, led us to believe that the generations did not exceed three for those two years. At Cornelia, Georgia, where the work was conducted in 1906, there was only a slight evidence of a part of a third generation. Being located in the mountains, the seasons are always two to three weeks shorter than they are at either Tallapoosa or Pomona, further south, and at the extreme foothills of the mountains, and this may account partially for the variations in the generations.

We ascertained the number of generations by selecting eggs of the first brood of moths and rearing the larvae that came from them in breeding cages on apples and later noting the emergence of the adults. Soon after the moths emerged, eggs would become quite numerous in the orchards showing that the majority of adults of that brood had emerged. Newly laid eggs were then collected for the next several days and the larvae reared and adults obtained from them as before, and so on for the entire season. The results obtained by means of breeding cages were checked by observations in the orchard. Just here, though, we wish to say that we have living specimens of larvae of each brood yet in cocoons that undoubtedly will not emerge as adults until spring. The fact proves conclusively that the insect is capable of living from ten to eleven months in the cocoon, and, in all probability, the hibernating larvae under certain conditions will live over an entire season and emerge the following year. A dry and well protected condition is one essential, we think, in causing the larvae to remain a considerable time in the cocoons.

**Comparative importance of different generations.** In the importance of the different generations when the moth's control is desired, the first is all important. On the time and proper spraying primarily for the first brood hangs 78 per cent. of the success in the control of the moth for the entire season. But considered from the size of each generation alone the moths increase greatly in number in each succeeding generation and their capacity for doing damage, all conditions equal, of course increases proportionally. In reality, the first brood, when considered alone, owing to its small size and the extra amount of fruit

generally on the trees at the time it appears, would not greatly affect the number of apples gathered in the fall. On the other hand, the second brood, plentiful in number and causing practically total loss of all infestations made, is felt the most. The third and fourth generations do not increase by any means in the same proportion as the first and second generations. Predaceous and parasitic enemies are at their best at the time at which the third and fourth generations appear, and the fruit, too, is large in size and infestations do not cause total loss as the apples will ripen normally and are of more or less value.

#### PARASITIC AND PREDACEOUS ENEMIES OF THE CODLING MOTH.

At no time during the life history of the codling moth is it secure from the attacks of enemies. Even the tiny eggs of the moth have their parasites.

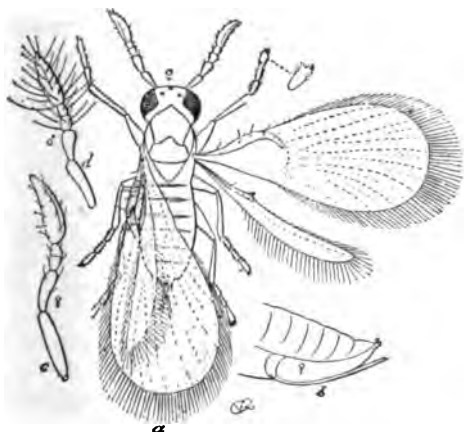


Fig. 7—*Trichogramma pretiosa*. Egg parasite of the codling moth, greatly enlarged. From (Riley, 4th Rept. Ent. Com., U. S. Dept. of Agri.).

*Trichogramma pretiosa*, Fig. 7, is the most beneficial parasite of the egg. It was observed working on the first brood of eggs in a small way and with the advent of the second brood, its efforts were encouragingly satisfactory. By consulting table on page 6 it will be seen that of 964 eggs observed of the second brood, 184 were parasitised, or in other words, a fraction over 19 per cent. It is a fact worthy of note that as the season advanced their work was more pronounced and that they aided materially in the control of the second and later broods. This parasite is widely distributed and is well known as attacking the egg and rendering invaluable service in lessening the losses from the

cotton worm. As high as five of these parasites were bred from a single egg not larger than an ordinary pin-head, and they may or may not emerge from their host through separate exit holes.

Of the enemies of the larval and pupal stages, the predaceous enemies are particularly abundant. Several species of spiders find in them a most tempting meal. The small red spider, *Anystis agilis*, is pre-eminently active. They can be found constantly traveling over the foliage of apple trees, and if by chance a newly hatched larva comes their way it is invariably seized. In our egg breeding experiments the first object to insure success was to be doubly sure that no red spiders were inclosed in the breeding jars.



Fig. 8—Pennsylvania soldier-beetle (*Chauliognathus pennsylvanicus*).

The larva of the Pennsylvania Soldier-beetle (*Chauliognathus pennsylvanicus*) Fig. 8, searches all nooks and crevices on the trunks of trees, and countless numbers of apple worms, while getting ready to spin their cocoons, fall victims to their greedy jaws. Even before the larvae leave the fruit and after they have made their cocoons they are located by this prying insect. Fig. 9 shows the larva attacking a codling moth larva; note the powerfully developed jaws.



Fig. 9—Larva of the Pennsylvania Soldier-beetle attacking a codling moth larva.

Most all ants will arrest the codling moth larvae in their exposed travels and with some species of ants the cocoon is not altogether a protection. Four species of ants: *Dorymyrmex pyramicus* Roger, *Stenamma (Aphaenogaster) fulvum* Roger var., *Monomorium minutum*

Mayr var. *minimum* Buckley, and *Cremastogaster ashmeadi* Mayr, were observed to gnaw into the cocoons and drag forth the larvae and eventually put them to death.

A hymenopterous parasite, *Haltichella* sp., was bred frequently from the pupae and seems to be quite a valuable parasite. The grub of this insect lives within the body of the larvae and the pupae of the apple worm until mature, and the adult eats its way through the pupal skin and cocoon of its host.

Birds are one of our most efficient aids in controlling the codling moth. Practically all birds that frequent apple orchards feed by chance, more or less, upon the several stages of the moth. One species, the downy woodpecker, needs to be pointed out particularly as working energetically, in season and out, in searching for the larvae and pupae in cocoons on the trunks of trees. The telltale hole in empty cocoons in early spring leaves no doubt of the valuable services rendered by this friend, the woodpecker.

Bats are recorded as feeding upon the adult moths. We have observed them circle about apple trees in their flight and it is likely that a great many adult moths perish in their frolicsome journeys late in the afternoon from this source.

Several other predaceous and parasitic enemies that aid in combating the codling moth have been noted in different sections, but as Prof. Slingerland has well said, "In spite of the numerous enemies, enough codling moths succeed in running the gauntlet every year to allow it to take rank as the most destructive apple pest in nearly all parts of the world."

## PART II.

### EXPERIMENTAL SPRAYING.

The spraying feature of the codling moth investigation was conducted in orchards at Tallapoosa and Pomona. At the former place trees of the Ben Davis variety composed experimental plats, and at the latter, Terry's Winter. The Ben Davis trees were eight years old and the crop gathered was the first important one borne by them. The majority of trees in the orchard at Tallapoosa, however, were from fifteen to twenty years old, and at no time had the orchard been sprayed for the codling moth. The Terry's Winter trees at Pomona were twelve to fifteen years old and had been sprayed from one to three times for the codling moth since they came into bearing, or yearly for six or seven years. From eight to twelve trees were included in each plat at both places and the arrangement of the check plats in the experiment block of trees was as is illustrated in charts I and II.

The locations of the experimental plats in the orchards and their proximity to storage houses and cellars (see charts I and II) were somewhat different, but both orchards were equally free from infestation from surrounding orchards.

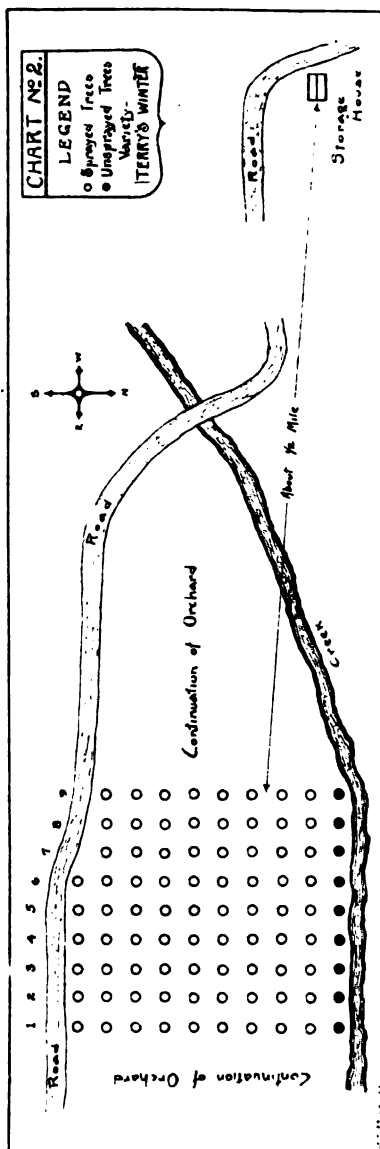
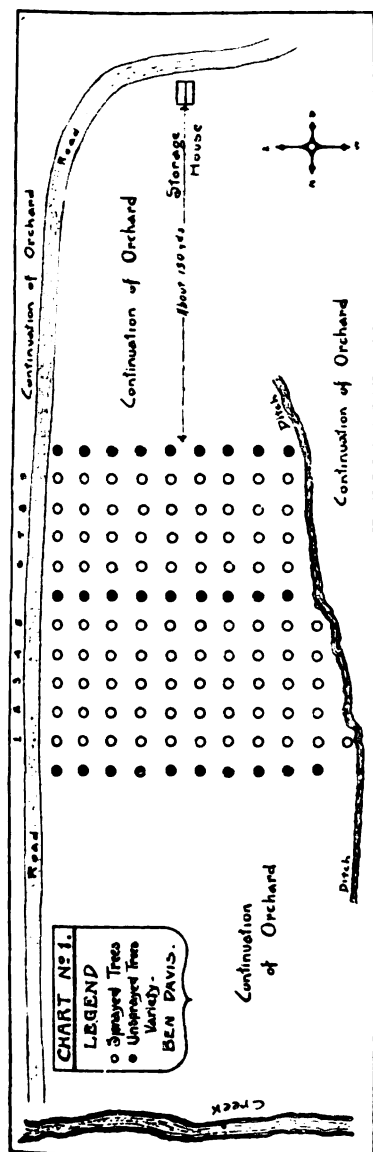
Arsenical Bordeaux of the formula, lime 6 pounds, bluestone 3 pounds, Disparene 2 pounds, water fifty gallons, was the spray used. The following spray outline was tested:

### SPRAYING OUTLINE.

Number of Sprayings and Time of Application as Indicated Below.

Plat.	Just as petals fall	Just before calyx closes	Ten days after last	14 days later	When 2nd brood appears. As eggs hatch.	Two weeks later
I	1st	2nd	3rd			
II	1st	2nd				
III		1st				
IV		1st		2nd		
V		1st			2nd	
VI		1st		2nd	3rd	
VII		1st		2nd	3rd	4th
VIII					1st	
IX					1st	2nd

Great care was taken to have the different sprayings applied at the designated time indicated in the outline, and the exact dates on which the sprayings were made were as follows:



Charts I. and II. Location and arrangement of the experimental trees in orchards.

# TALLAPOOSA.

Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.	Plat 6.	Plat 7.	Plat 8.	Plat 9.
1-Apr. 6.....	Apr. 6	Apr. 13	Apr. 13	Apr. 13	Apr. 13	Apr. 13	Jun. 12	Jun. 12
2- " 13.....	13		27	Jun. 12	27	27		26
3- " 23.....					Jun. 12	Jun. 12		
4.....						26		

# POMONA.

Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.	Plat 6.	Plat 7.	Plat 8.	Plat 9.
1-Apr. 8.....	Apr. 8	Apr. 16	Apr. 16	Apr. 16	Apr. 16	Apr. 16	Jun. 10	Jun. 10
2- " 16.....	16		30	Jun. 10	30	30		24
3- " 27.....					Jun. 10	Jun. 10		
4.....						24		

## RESULTS OF EXPERIMENTAL SPRAYING.

The apples were gathered at Tallapoosa September 14th and at Pomona October 15th. At the former place each apple was examined and the results obtained were absolutely correct. At Pomona, owing to the abundant yield and the limited time in which the writer had to gather the fruit, the apples from only one tree in each of the experiment plats entered into the final results. The apples from the one tree selected in each plat were gathered and the yield carefully estimated. A uniform number of apples, (five hundred), gathered from each of the several trees, were examined and the results obtained applied to the whole as an average.

## TABLE OF RESULTS.

Plat	Variety	No. trees in plat	Fruit wormy per cent.	Fruit not wormy per cent.	Crop protected from codling moth per cent.
1	Ben Davis	11	13	87	55
2	" "	10	12	88	56
3	" "	10	16	84	52
4	" "	10	13	87	55
5	" "	10	7	93	61
6	" "	9	4	96	64
7	" "	9	5	95	63
8	" "	9	67	33	1
9	" "	9	63	37	5
10	Check plat	28	68	32	0
1	Terry's Winter	9	7	93	45
2	" "	9	10	90	42
3	" "	9	10	90	42
4	" "	9	6	94	46
5	" "	9	6	94	46
6	" "	9	3	97	49
7	" "	8	7	93	45
8	" "	8	50	50	2
9	" "	8	49	51	3
10	Check plat	9	52	48	0

In figures 10, 11, 12 and 13 is shown the crop from a single tree in plats 3, 4, 6 and 10 at Pomona, of the Terry's Winter variety. Figure 13 represents the yield from a single tree in the check plat. Normally, all conditions equal, the yield from the check tree would be even greater than the results figured from any of the sprayed trees, and the prevention of codling moth infestation by spraying really constitutes only a very small proportion of the benefits.

How the spray poisons the larvae and otherwise prevents injury from the codling moth. The codling moth is controlled by spraying in two important ways, namely: by the larva being actually poisoned in feeding, and by the non-protective effect that sprayed trees furnish the adult moths, preventing them to some extent from depositing their eggs.

It is widely known that the most effective time to spray for the moth is before the calyx lobes close (compare Figs. 14 and 15). Owing to the habits of the larvae of generally entering the fruit at the calyx end, the placing of poison within the calyx cavity before the lobes close is very essential, for nature in the course of a few days so protects the poison that it is conserved and securely hidden in the calyx cavity where, even several weeks later, it is found by the young larvae. However, the specific results that follow spraying before the calyx closes should not be attributed entirely to the poison within the calyx cup for the poison on the foliage aids materially in preventing infestation. In fact, 86 per cent. of the eggs are deposited on the leaves and most of the larvae are forced to subsist for some time on the foliage, and, where spraying is practiced, only a very small number of larvae succeed in reaching the fruit. But for those that do, the poison in the calyx-cup is practically the only remaining safeguard as very little of the spray mixture adheres to the surface of the apple.

The white color or non-protective effect that sprayed trees furnish the adult moth is of course of minor importance as compared to the poisoning effect of the spray. That to a certain extent it is beneficial can not be doubted. No matter how scrutinizing the examination, eggs are found less frequently on sprayed than on unsprayed trees.

Does the spray affect the eggs? It occurred to us that the eggs being so frail perhaps the spray would affect their development. Accordingly a number of eggs deposited on the foliage were collected and sprayed carefully and notes made on their development. Of the forty tested they all developed regularly and normally.

#### GENERAL BENEFITS OF SPRAYING.

Spraying, we believe a prime necessity for profitable apple culture in Georgia. Not alone is it important in the control of the codling moth, but it is equally as necessary in preventing fungus diseases, such as leaf spot, apple scab and bitter rot in certain localities. By the use of a combination arsenical and fungicidal spray, as Arsenical



**Fig. 10—Fruit from tree in plat 3. Apples on ground sound, those in basket wormy.**



**Fig. 11—Fruit from tree in plat 4. Apples on ground sound, those in basket wormy.**



**Fig. 12—Fruit from tree in plat 6. Apples on the ground sound, those in basket wormy.**



**Fig. 13—Fruit from an unsprayed tree. Apples to the right sound and those in and near basket wormy.**



Fig. 14—Apples with calyx open and in just the right stage for the first spraying.



Fig. 15—Apples with calyx partly closed and too late for the most effective spraying.

Bordeaux, the treatment of these several troubles is combined and the cost reduced to a pittance when compared to the higher percentage of sound, bright fruit gathered at picking time that would not otherwise be obtained.



Fig. 16—Tree in check plat at gathering time. Note the defoliation due to leaf spot, and scarcity of apples on tree.

One thorough spraying with Bordeaux just after the trees have fully leafed out is sufficient an ordinary year to control leaf spot. During an exceedingly rainy season two sprayings, the second coming three to four weeks after the first, give better results, in that the apples are colored more highly. By comparing Figs. 16 and 17, the importance of preventing leaf spot is more readily appreciated. It might also be stated that the apples gathered from the unsprayed trees sold for just half what those did that came off the sprayed trees, and that the yield was only about a fourth what it would have been if trees had been sprayed properly.

**Some harmful effects of improper spraying.** Where Bordeaux enters into the arsenical spray, care must be taken that it be not too strong. The use of more than three pounds of bluestone in fifty gallons of



Fig. 17—Sprayed only once, about the time the tree was fully leafed out. Photo taken at gathering time. Note the abundant foliage and apples on the tree.

spray mixture is unnecessary and inadvisable as a greater amount is liable to injure the foliage and even the apples. Fig. 18 *a* shows a slight injury to the fruit from a too strong or too frequent application of Bordeaux. Fig 18 *b*, with russeted bands encircling the fruit at right angle to the axis, is result of frost injury and is frequently mistaken for Bordeaux injury.



Fig. 18—*a*. An apple slightly injured by Bordeaux. *b*. Slightly injured by frost, sometimes mistaken for Bordeaux injury.

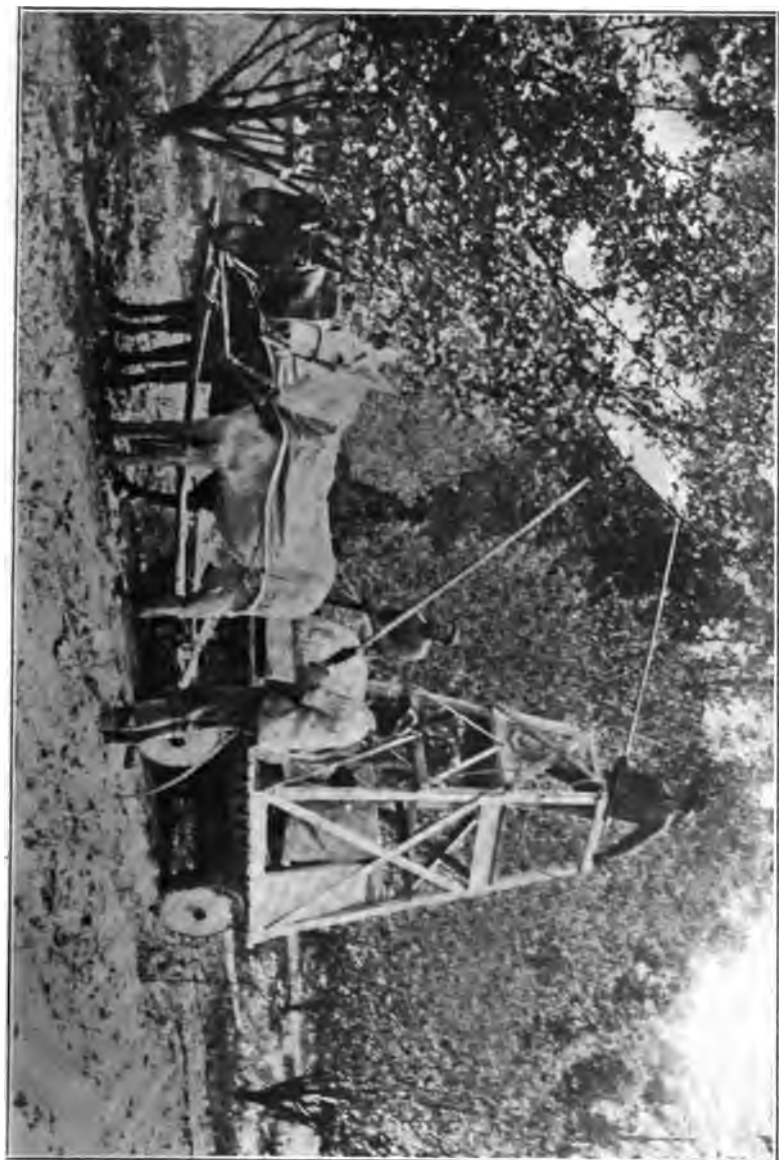


Fig. 10.—Spraying by gasoline power in orchard of Wayman and Riegel, Pomona, Ga.

## SPRAYING APPARATUS AND ACCESSORIES.

The orchardist can not expect good results from spraying for the codling moth or apple diseases unless he is properly equipped with spraying apparatus and accessories. Primarily there are three types of pumps suitable for orchard work, namely, the barrel pump, the hand-power tank outfit, and the gasoline power sprayer. The first named is reasonably cheap and well adapted for use in home orchard or orchard of a few hundred trees. The hand-power tank outfit is practically the barrel pump on a larger scale, and for large orchards is preferable to the barrel pump only in point of economy. When the orchardist's interest warrants a gasoline or other power sprayer (Fig. 19), that will easily maintain, for several leads of hose, a pressure of one hundred to one hundred and fifty pounds should be used. A high pressure insures a mist-like spray and an even distribution of poison.

Twenty-five to thirty foot leads of hose, with bamboo extension rods should be part of the equipment of any spray outfit. A common defect in many outfits is that the hose is not of sufficient length to enable the operator to spray all sides of the tree. Where high and uniform pressure can be maintained, as with the gasoline power sprayer, double compound nozzles are most advisable to use. In case the power is furnished by hand, as in the barrel or tank outfit, it is hardly possible to furnish two leads of hose with sufficient pressure for more than double nozzles for each hose. In spraying for the codling moth the nozzle should be set at an angle of 45 degrees (Fig. 20) so that the spray can be directed either upward or downward at the will of the operator.

**Water supply.** One essential factor in the economy of the actual operation of spraying is the water supply. Where the orchard interest warrants it, a supply tank is advisable, as illustrated in Fig. 21. By means of the pump on the tank water is drawn up from the branch and discharged into mixing barrels; later the spray mixture from the mixing barrels into the supply tank, where it is then hauled and discharged into the spray tank (Fig. 22). The actual operation of transferring one hundred and fifty gallons of spray mixture from the supply

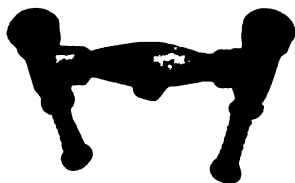


Fig. 20—Nozzle set at the proper angle to spray for the codling moth.

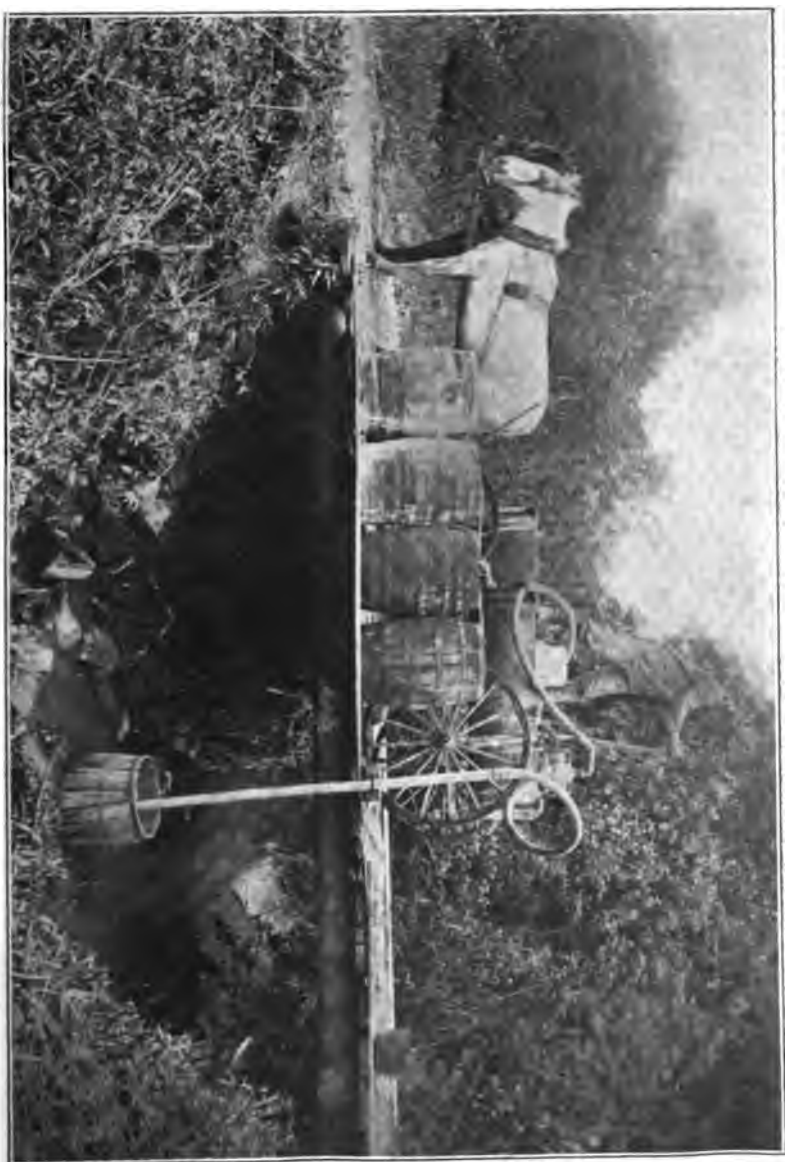


Fig. 21.—Water and spray supply outfit used by Wayman and Riegel, Pomona, Ga.

tank to the spray tank consumes from three to four minutes with the above equipment.

**Preparation of Arsenical Bordeaux.** Slake the lime carefully with enough water to reduce it to the consistency of cream and dilute to twenty-five gallons. Dissolve the bluestone (copper sulphate) in twenty-five gallons of water by suspending the crystals in a coarse sack a few inches below the surface of the water. Some thirty or forty minutes are necessary for the bluestone to dissolve. Take a third barrel and pour the two solutions together simultaneously by dipping a pail full of each and allowing the streams of the two to mingle in midair as they are poured into the barrel. After thoroughly stirring, the Bordeaux will be ready for use. It should be thoroughly strained to prevent any foreign matter entering the spray pump to clog the nozzles. The disparene should be dissolved in water and then added to the Bordeaux. The dissolving of the disparene is more easily accomplished by placing the paste in a strainer and pumping a steady stream of water on the paste and forcing it through the strainer.



Fig. 22—Supply tank transferring the spray mixture to the spray tank.



Fig. 23—Method of banding.

**Banding as an adjunct method of fighting the Codling Moth.** Banding prior to 1880 was the very best method known for fighting the codling moth. The banding system, generally speaking, consists simply of tying a strip of coarse cloth around the trunk or main branches of the tree to furnish the larvae a good place to spin their cocoons, and then killing them after they have done so. (Fig. 23.)

In order to test the value of the banding system, sixteen trees were selected and bands placed around them on May 18th. The bands were examined weekly until August 11th and afterwards at irregular intervals until September 28th, when the final examination was made. The table following gives the combined number of larvae caught from the sixteen trees at each examination:

Date of Ex.	Larvae caught	Date of Ex.	Larvae caught	Date of Ex.	Larvae caught
May 18	0	June 29	32	Aug. 11	63
May 25	25	July 6	18	" 24	151
Jun. 1	61	" 13	48	Sept. 7	137
" 8	30	" 20	70	" 14	85
" 15	28	" 27	133	" 28	92
" 22	43	Aug. 3	105		

From five of the sixteen trees, 3,920 infested apples were gathered; or, in other words, eight and a fraction per cent. of the codling moth larvae that entered the fruit were trapped.

In view of the fact that so few larvae are trapped beneath the bands and that considerable time is consumed in examining the bands weekly, the banding system, to put it mildly, is an entirely obsolete method, even as an adjunct, of fighting the codling moth economically and advantageously.

**Beneficial measures in controlling the Codling Moth.** Of the beneficial measures against the codling moth clean culture is one of value. Clean culture, with most hibernating insects, can not be recommended too highly. The fact that the larvae pass the winter in cocoons under the rough, loose bark on the trunks of the trees, where sufficient protection is afforded them, makes it very important that the trunks of the trees be kept clean of loose bark, as well as the orchard free from rubbish or other suitable hibernating places. The dead bark can be cleaned from the trees to a great extent by spraying with Bordeaux or by thoroughly scraping the trunks of the trees with a blunt tool of some kind.

As already stated, cellars and storage houses constitute an important source of infestation. Hundreds of larvae are taken with the fruit in the fall to cellars and storage houses where they hibernate until spring, and ordinarily when the adult moths appear they make their escape to some nearby orchard. Where it is possible to screen the cellars or storage houses, it is not necessary to seek out the cocoons in winter; instead the adult moths may be allowed to emerge and literally starve to death in the screened compartments.

### SUMMARY AND RECOMMENDATIONS.

The first or hibernating codling moths make their appearance in from ten days to two weeks after the apples bloom in spring.

Eighty-six per cent. of the eggs are laid on the upper surfaces of the leaves, and the young larvae in a great many cases are forced to subsist for several days by feeding on the leaves before they find an apple.

About three-fourths of the larvae enter the fruit by way of the calyx end.

Approximately seven weeks are consumed in the life cycle of the moth, and we have three and a part of a fourth generation, or brood, when spring opens early.

Parasites and predaceous enemies of the moth are very active and aid materially in holding the pest in check.

The annual loss from the codling moth in the State is safely from fifty to seventy per cent. of the apple crop where spraying is not practiced.

The time to apply the first spraying is just before the calyx closes. On the time and proper application of this spraying hangs 78 per cent. of the success in the control of the codling moth for the entire season.

Two sprayings, the first applied just before the calyx closes and the second from seven to eight weeks later when the second brood appears, give the best results from an economic standpoint, 90 per cent. of the fruit being protected.

Late sprayings alone are of very little value and, unless preceded by a spraying before the calyx closes, should not be attempted.

Careful attention should be given the spray operation. All parts of the tree should be thoroughly covered and the spray applied until it drops freely from the foliage. To do this most conveniently a high pressure should be maintained so as to secure a mist-like spray, and the nozzle should be turned at an angle so that the operator can direct the spray either upward or downward at his will.

Banding even as an adjunct method of fighting the codling moth is a waste of time.

Spraying costs a mere trifle as compared to the value of the crop protected from the codling moth.









## NOTICE.

The Bulletins of the Georgia State Board of Entomology, which are of present practical value and still available, are mentioned below. (The numbers not mentioned are either out of date or exhausted). Application for any of these numbers should be addressed to the State Entomologist, Atlanta, Ga.

Bulletin No. 12.—Mexican Cotton Boll Weevil.

Bulletin No. 13.—Some Common Insects Injurious to the Apple.

Bulletin No. 14.—Pear Blight Disease in Georgia, and Pear Leaf Blight.

Bulletin No. 20.—Part I. Report of State Entomologist for 1906.

### Part II. Crop Pest Law and Regulations.

Bulletin No. 21.—Spraying to Control the San Jose Scale.

Bulletin No. 22.—Black Root Disease of Cotton.

Bulletin No. 23.—The Apple Woolly Aphis. Green Apple Leaf Aphis.

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Bulletin No. 24.—Cotton Anthracnose and Cotton "Rusts."

Bulletin No. 26.—Peach Leaf Curl, Yellows, Rosette and Little Peach.

Bulletin No. 27.—Proceedings of Horticultural Society for 1908.

Bulletin No. 28.—"Black Root" Disease of Cotton in Georgia and its Control.

Circular No. 6.—The Use of Soluble Oils Against San Jose Scale.

Circular No. 7.—The Hessian Fly in Georgia.

Circular No. 8.—Report on Experiments for Control of San Jose Scale. 1907-1908.

Circular No. 9.—The Brown-Tail Moth.

E. L. WORSHAM.

State Entomologist.

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# Georgia State Board of Entomology

BULLETIN No. 30.

DECEMBER, 1909

Proceedings  
Of the Thirty-third Annual Meeting of the

## Georgia State Horticultural Society

Held at Athens, Georgia,  
August 4th and 5th, 1909

Published by the State Board of Entomology  
and State Horticultural Society.

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# Georgia State Board of Entomology

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## PREFATORY.

Many circumstances caused a smaller attendance at this session than usual. Several of our leading members were on their vacations abroad and in other States; others objected to being present, owing to excessive hot weather; again, the failure of the fruit crop in many sections of the State and the protracted drought which prevailed lately prevented our exhibit of fruits and vegetables from being as large as usual. To offset the objections of many who fail to attend our sessions on the plea of hot weather and busy occupations, the Society has changed the traditional time of meeting in August to the fourth Wednesday (26th) of January, 1910, when the Thirty-fourth Annual Session will be held at Sparta, Georgia, which is a convenient central point of the State. As the weather will then be less uncomfortable, and orchard and farm work less pressing, it is hoped that every person interested in the progress of fruit growing and correlated industries will be present and aid in keeping the Society up to the degree of usefulness which it has striven for thirty-three years to maintain. Let every public spirited citizen of Georgia come to Sparta; and thus show his appreciation of the work which this organization is and has been doing for the benefit of our State.

Our Sparta friends are making special preparations for entertaining the members of the Society. Let the attendance be as large and enthusiastic as it was in former years. This can be done by an effort on your part, and remember the date, January 26th, 1910.

## PROCEEDINGS.

---

President P. J. Berckmans, of Augusta, called the meeting to order at 10:30 a. m., but, as quite a number of the members were not present and were likely to arrive on early trains, adjournment was had, at the suggestion of the President, until 3 p. m.

Prof. McHatton, of the Georgia State College of Agriculture, invited such members as were present, in the meantime, to ride out and visit the grounds and buildings of the new College of Agriculture, which invitation was accepted and the members made a very delightful and interesting tour under the guidance of Prof. McHatton.

The President called the meeting to order the second time at 3 p. m., when a larger membership was present.

Rev. M. L. Troutman, pastor of the First Methodist Church of Athens, invoked the divine blessing for a successful and beneficial meeting.

Hon. W. F. Dorsey, Mayor of the City of Athens, welcomed the members and guests to the city, to its churches, its homes, its institutions of learning, and to its near-beer saloons, if any of the members could afford the time.

Col. B. W. Hunt, one of the Society's oldest and most valued members, in appropriate words responded to the address of welcome, and thanked the citizens of Athens for their good wishes and kind offerings of hospitality.

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### THE PRESIDENT'S ADDRESS.

Members of the Georgia State Horticultural Society, Ladies and Gentlemen:

I regret exceedingly that our attendance this year is so small. There are a great many reasons for this, I suppose; the weather has

been very warm, a great many are on vacations, and a great many seem to have lost that interest in the work of the Society that we had hoped and expected they would continue.

Seven years ago we had the pleasure of holding our annual session in this city, but, owing to the desire of the Georgia State Agricultural Society and of the Dairymen's Association to have a joint meeting with the Horticultural Society, the time allotted to each body was too limited to permit the work of our session to be altogether satisfactory as to the results. We meet today under many more pleasing circumstances, therefore each subject which will be presented by our members can receive ample time for your consideration and discussion.

It affords me sincere pleasure in again greeting you, and I am sure that I voice the sentiments of our members and co-workers in saying that we are glad to once more hold our annual reunion in this city, noted as an educational center and for its culture. We congratulate this city on the rapid progress which it has made since we met here before, more especially upon having lately inaugurated the magnificent State College of Agriculture, in which at last our State must be congratulated that a real College of Agriculture, well equipped and with an up-to-date faculty of earnest and efficient workers, has been added to its educational facilities, and know that our young men, looking to the life and vocation of an Agriculturist, need not go away from Georgia and seek instruction elsewhere to become properly fitted for the career of a successful tiller of the soil. Every branch of the products of our soil and correlated industries, is receiving untold benefits from this institution from whose influence new life is given to what is man's oldest pursuit and will help it to become the most perfect.

I cannot make an enumeration of the various things which a man ought to know who aspires to be a successful Horticulturist, because the subjects pertaining to this science are too extensive, and as more and more are being daily added thereto by the many scientific as well as practical discoveries in this age of progress, our pursuit has now become one of specialties.

As it is impossible that one man can be expected to know all of these various things, we can only acquire sufficient knowledge of the minutiae of each special method of cultivation from the experience of those who have become experts in the different subjects within the domain of Horticulture.

Therefore your Society is fortunate in having so many present who, following different lines in these pleasant and productive arts, will give the results of their experience; which, being freely offered, makes a combination of advantages seldom found when one depends entirely upon himself, or even gains knowledge from reading books and periodicals.

There is some difference of opinion as to whether Agriculture or Horticulture was man's first occupation, but fruit growers contend that, as Adam was the first man engaged in that particular art, and his location being in a garden called Eden, we, as Horticulturalists, may claim priority; and that, while we have made considerable progress in advancing this art, still we recognize that advancement in any of the arts pertaining to the soil has been in an inverse ratio with their antiquity.

The cotton trade, which is today receiving such careful and scientific consideration, is older than either the ancient wool or silk trade, but Horticulture is now making more rapid strides than it did during the past generation, because as the human mind is advanced and free from formerly established prejudices, which made many things obscure, these we have no longer to contend with; thanks to our modern scientists who cleared the highway from these obstacles.

### **FINANCES.**

As stated at a previous reunion, our treasury is not as replete as is consistent with the scope of our work. Only by the strictest economy in husbanding our resources, have we been enabled to meet the necessary expenses incident with holding our sessions, and to carry over a very modest balance to our credit; this must gradually diminish unless our membership increases. This can be accomplished by your individual efforts towards enlisting new members. If each of you will secure a new recruit and continue your affiliation, the condition of your treasury would soon improve. The report of the proceedings of 1908 is larger than that of any previous session, and had it not been that the State Board of Entomology generously aided in paying a part of the expenses in publishing it as a bulletin of the Department that volume would necessarily have been much reduced in size and valuable information. This report has been distributed to the leading farmers and horticulturists of Georgia, many of whom have doubtless received valuable suggestions therefrom, and we trust many will be induced in return to affiliate with this Society. I am sure that you will acknowledge the aid given you by the Board of Entomology.

### **CHANGING THE TIME OF THE ANNUAL SESSIONS.**

This question was considered at the Augusta meeting in 1907, but no action was taken because the selection of the time would depend upon the next place of meeting. Upper Georgia would likely be preferred for a summer session and south Georgia for a winter, as Cornelia was selected, and the City of Athens honored us with an invitation for this year. This question is therefore still in abeyance, and I call your attention to it for action at this time.

## **THE FRUIT EXCHANGE.**

With the rapid increase in fruit products, it became evident some years ago that a combination of all fruit growers was necessary, in order to perfect better methods of disposing of their fruits. As this was eminently the commercial feature of the industry, the Georgia Peach Growers Association was the outcome of these conditions, and relieved the Horticultural Society of the commercial work, leaving the scientific investigations as its special province. After several years of existence, the peach growers recognize the importance of organizing their association upon a strictly business plan, and through the suggestions of the State Horticultural Society at its past two annual sessions, The Fruit Exchange was perfected during the past year. Its work has been eminently successful; while a crop of only 2,000 car loads of peaches was marketed this year, still it brought nearly \$1,500,000.00, or about the same money returns which a crop of nearly 7,000 car loads brought last year. This is the result of systematic business methods, which in future years will make commercial fruit growing more lucrative and increase this industry, because fruit growers will no longer be at the mercy of glutted markets and irresponsible commission merchants.

## **BROWN ROT.**

This has been exceedingly prevalent in nearly all sections of Georgia, and there has been a great clamor for years past for a satisfactory treatment. Now, thanks to the experiments of our former State Entomologist, Mr. W. M. Scott, acting under the auspices of the Pathologist of the U. S. Department of Agriculture, this scourge of our peach crop is likely to be controlled. Mr. F. W. Ayres, who is Mr. Scott's assistant, has been requested by Mr. M. B. Waite, Chief Pathologist, to attend this session and give you the results of this year's experiments in controlling the Brown Rot.

## **NECROLOGY.**

As our Society is growing older in years, we must expect our ranks to become gradually depleted of those who have for so many years aided in its work. In the death of Captain Robt. E. Park, who served you so long and faithfully as Vice-President of the Fifth Congressional District, we have lost one of our most efficient and useful associates. No man was more friendly to our Society; he was a conscientious worker and helped in demonstrating that in the pursuit of Horticulture the highest faculties of the human intellect may be exercised. As a State official he was noted for his integrity and sound business judgment, which are a record to a good and faithful citizen. We owe to his memory that a page be dedicated in our forthcoming proceedings as a testimony of the high esteem in which we held him as our friend and associate.

Dr. F. M. Hexamer, long an honorary member, died in July at his home in Stamford, Connecticut. Many of you have known of him only as one of the most scientific as well as practical writers upon Horticulture, from his prominent editorial management of the American Agriculturalist, and his lectures upon subjects germane to this pursuit; but those who had the privilege of his intimate friendship, knew him best as a devoted friend, loyal to every progress, and a man as simple in his intercourse with others as he was scientific in his chosen calling.

### BIRD PROTECTION.

At the risk of being insistent, I cannot refrain from again calling your attention to the necessity of protecting insectivorous insects. This I have mentioned repeatedly during former occasions, and I hope that every one of you will make an effort to prevent the killing of the best friends of the Horticulturist. A new game law has been introduced during the present session of the Georgia Legislature; one of its provisions is to extend the close season for hunting quails and doves, but this is not sufficient to prevent the gradual extinction of our winged allies. A law covering a period of from two to three years, during which it would be unlawful to kill any dove, quail, wild turkey, robins, field larks and other well-known insectivorous birds, should be enacted and enforced; otherwise we must expect to have our field and orchard crops annihilated by hordes of insects, which all efforts of our entomologists will not be able to prevent increasing. Every land owner should be his own game warden and thus protect, upon his lands, the best workers in his behalf.

There are other topics which will require your consideration, but these will no doubt be referred to during your deliberations. I must not take up more of your time in these cursory remarks, which are prompted by my heartfelt interest in the policy that seeks to extend the productive resources and the refinement in the education of our commonwealth through the united efforts of the Georgia Horticultural Society.

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The PRESIDENT: Gentlemen, it is impossible for the chair to appoint any committees until I have the roll of the members present. I will ask the Secretary to prepare that list, and those who have not paid their dues to the Treasurer will now have an opportunity of doing so; and those who wish to become members of the Society will have this opportunity to become affiliated and

let their names be included in the list from which I am to appoint committees. A few moments of recess will be necessary before this can be done. We have so very few fruits on exhibition this year that it will not be necessary to appoint a very extensive Committee on Examination of Fruits. I will appoint Col. Brackett as the Chairman of that Committee; he may choose one associate, and report to me tomorrow.

Col. BRACKETT: I would prefer that you appoint the other member yourself, Mr. President.

The PRESIDENT: I will perfect the committees in a few minutes. Dr. Niles is here; he has a very valuable paper to present, and, as he desires to leave on an early train today, I will ask the Doctor to take the floor.

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## **SOME COMMENTS ON THE NUTRITIVE AND ECONOMIC VALUE OF NUTS.**

By Geo. M. Niles, M. D., Atlanta, Ga.

Mr. President and Members of the Georgia State Horticultural Society:

Up to a comparatively recent date nuts were considered by most people either a luxury or as tidbits to be eaten out of hand at odd times. They had no fixed standing as to food value, often being unjustly blamed for indigestion brought on by other causes.

During the last two decades, however, both from a dietetic and an economic standpoint, they are becoming more appreciated, as evidenced by their increased consumption.

With this greatly augmented demand the Southern States are much concerned, for two of the principal nuts, the peanut and pecan, are largely Southern products.

It may surprise this Society to be informed that the total quantity of nuts imported into the United States in 1907 was 86,238,000 pounds, with a value of over \$6,000,000.00. From Georgia, North Carolina, Virginia and Tennessee the yield of peanuts alone was 225,000,000 pounds. The exact yield of pecans could not be obtained, but it was

large; and, when the many groves now growing in Georgia come into bearing, the pecan crop alone will hold a respectable place among the resources of our State.

Several conditions have aided in bringing to the people at large an appreciation of this important source of nutriment. The increased cost of the various meats exacted by the packing trusts has quickened interest in the economic value of nuts; many special nut foods, such as malted nuts, nut butters, and meat substitutes with nuts as a basis, being now on the market at reasonable prices. Again, there is a fairly large number of our population who, for different reasons, abstain from meat. In this connection might be mentioned the Seventh Day Adventists, a growing body in the South, whose teachings are opposed to the use of meat in any form.

I feel, therefore, that a brief survey of this somewhat neglected field will both entertain and profit my hearers.

The term "nut" is applied somewhat loosely to certain varieties of fruits, and implies a more or less fibrous covering surrounding a kernel of meat. They are produced in the most diverse manners, from vine-like plants, as the peanuts, up to the giant pine or beech. One variety, the water chestnut, is supplied by a water plant.

To enter into a description of the many native and imported nuts available for food consumption would exceed the limits of this paper, so I shall consider only a few of the best known.

The flavor of nuts depends principally on the oils they contain, though in some there are specific flavoring agents. Some of these oily constituents easily become rancid, imparting a most disagreeable taste or odor. The peculiar flavor of the roasted peanut is due to browned oils and starches. The pungent or bitter taste of almonds, as well as peach and plum pits, a family botanically allied, is due to a cyanic acid yielding glucosid. The chestnut, especially when roasted, has a characteristic starchy taste, betokening its main ingredient. The flavor of nuts, as well as their size, can be greatly improved by judicious cultivation, as can be easily demonstrated to you by those who have intelligently studied this branch of horticulture.

The composition of nuts has been investigated at several of the agricultural experiment stations in this country, and I wish in this connection to acknowledge valuable data furnished me by Prof. M. E. Jaffa, of the California Station, and Mr. Charles D. Woods, of the Maine Station.

Right here it is well that I should explain some of the terms necessarily used in describing the constituent elements of food contained in nuts and the resultant energy produced thereby.

By the term *protein* we mean the important and essential nitrogenous constituent of animal and vegetable tissues. As examples of animal tissues strong in protein may be cited beefsteak and eggs; while

in the vegetable kingdom may be mentioned nuts, beans and peas. The proteins are of the greatest service to the animal economy. They help build up new tissue, repair waste of the old; and as fuel, which is burned in the body, they furnish energy and heat.

The *carbohydrates* contain no nitrogen, and include the starches, the sugars, the vegetable fiber or cellulose. Carbohydrates are burned up in the body, the resultant energy being changed into heat or muscular force, or converted into fat and stored up in the body. On account of their easy digestion and assimilation the carbohydrates are the most available source of heat and energy.

Fat or *hydrocarbon* is an important element in food, serving the same purpose as the carbohydrates, more valuable weight for weight as a source of energy, but neither so easily digested nor so available. Fat is found in animal foods, such as meat, fish and butter, and in vegetable foods, as oils in the various cereals and in the kernels of nuts.

A certain amount of waste or refuse is associated with nearly all food stuffs, and need not be discussed here.

As the foot is a unit of measurement, or the dollar a unit of monetary value, so we use the term *calorie* as a unit of heat, and it means the amount of heat required to raise the temperature of one kilogram, or about a quart of water, one degree Centigrade, or approximately two degrees Fahrenheit. To illustrate, about 3,000 calories daily are needed by a man weighing 154 pounds, taking ordinary exercise.

This brief explanation will, I trust, render intelligible the following table, which shows the composition of some of the nuts most used, as compared with a few of the staple food products.

EDIBLE PORTION.								
KINDS OF FOOD.	Refuse.	Water.	Prot'in	Fat.	Carbohydrates.		Ash.	Fuel value per lb.
					Sugar, starch, etc.	Crude fiber.		
	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Per ct.	Calories
Brazil nut.....	49.35	4.7	17.4	65.0	5.7	3.9	3.3	3,120
Chestnut.....	23.40	6.1	7.8	8.8	70.1	2.9	2.4	1,840
Cocconut.....	34.66	13.0	6.6	56.2	13.7	8.9	1.8	2,840
Hickory nut.....	62.20	3.7	15.4	67.4	11.4	2.1	2.2	3,345
Peanut.....	27.04	7.4	29.8	43.5	14.7	2.4	2.2	2,610
Pecan.....	50.10	3.4	12.1	70.7	8.5	3.7	1.3	3,500
Walnut.....	58.80	3.4	18.2	60.7	13.7	2.3	1.7	3,075
Beefsteak (round).....	-----	65.5	19.8	13.6	-----	-----	1.1	.950
Cheese.....	-----	27.4	27.7	36.8	4.1	-----	3.7	2,145
Eggs, boiled.....	11.20	65.0	12.4	10.7	-----	-----	.7	.680
Whitebread.....	-----	35.3	0.2	1.3	55.2	.5	1.1	1,215
Beans, dried.....	-----	12.6	22.5	1.8	55.6	4.4	3.5	1,606
Potatoes.....	20.0	78.3	2.2	.1	18.0	.1	1.0	.385

You will observe from this comparison that nuts, even the starchy chestnuts, furnish more fuel value per pound than either beef, eggs or

cheese. They are rich in protein and fat, containing some starch and but little water. The pecan is the richest in fat, though the Brazil nut, hickory nut and walnut are not far behind. In protein the peanut easily leads, containing 29.3 per cent. per pound, while round steak contains only 19.8 per cent. The chestnut has much the largest carbohydrate content, 73 per cent., though the peanut shows nearly 18 per cent.

Nuts are also well supplied with mineral matter. The ash of the walnut, almond, etc., is rich in phosphoric acid, comparing favorably with some of the cereals.

As to the digestibility of nuts I am free to admit that they are in some disrepute. The cause of this, however, is mainly due either to insufficient mastication, to crowding the stomach with them after a hearty meal, or to eating them at unseasonable hours. When they are accorded a proper place in the dietary, doubtless they will soon overcome this disfavor.

Prof. Jaffa reports a number of investigations carried on with a fruit and nut diet, some on vegetarians, some on fruitarians, and some on subjects who had lived on an ordinary mixed regimen. The general results as to the *coefficient of digestibility of nuts*, meaning by this the available percentage of nutriment, showed protein 90 per cent., fat 95 per cent., and carbohydrates 97 per cent.

As most of the experiments recorded at the California and Maine experiment stations comprised some nuts not in general use in the Southern States, I desired to form an intelligent opinion as to the digestibility and economic value of the pecan, peanut, and Brazil nut, these three being the ones most in favor with us.

For this purpose I enlisted the aid of Messrs. J. I. Matthews, J. G. Devane, W. L. Morris, G. D. Thompson, S. A. Kirkland and E. S. Deaver, all these being students at the Atlanta School of Medicine. These young men voluntarily offered their co-operation, and deserve much credit for the painstaking manner in which they followed my directions.

They were allowed a sufficiency of carbohydrates, as bread and fruit, but took no meat, eggs, butter, peas or beans. Their digestive functions, which were tested before going on this diet, were found to be normal. Each day they were weighed, their general condition was noted, and their excretions carefully examined.

This diet was kept for four days with five of them, and three days with Deaver, this young man becoming somewhat nauseated at the end of that time. He discontinued the nuts by my order, though entirely willing to go on with them.

The following table will give only the main findings, as an elaboration of all the figures for each man each day would be tedious.

Name	Nuts.	No. Days.	Lbs. used.	Weight at start.	Weight at finish.	Cost	Remarks
Devane.....	Pecan	4	3¾	140.5 oz.	141.10 oz.	75c	Normal condition.
Morris.....	Pecan	4	4	159.11 oz.	159.6 oz.	80c	Normal condition.
Thompson.....	Brasil	4	4¾	140.1 oz.	140.6 oz.	85c	Normal condition.
Deaver.....	Brasil	3	3¾	168.5 oz.	168.0 oz.	55 c	Somewhat nauseated
Kirkland.....	Peanuts	4	4	135.6 oz.	133.14 oz.	80c	Normal condition.
Matthew.....	Peanuts	4	3¾	160.8 oz.	162.4 oz.	75c	Normal condition.

It will be seen that two gained in weight, that three remained about the same, there being a loss of only a few ounces, while only one lost weight appreciably. That the calories furnished were sufficient showed in their feeling of strength and buoyancy. They had no disturbance of either stomach or intestinal function, with the slight exception mentioned. During each day of this experiment these young men seemed "fit" in every way; and when the cost of these results, bearing in mind the amount of heat and energy produced, is compared with the cost of a given amount of meat necessary to generate the same heat and energy, it is enough to make a thoughtful observer sit up and take notice.

As has been shown by the foregoing, as well as proved by other observers, the rich content of protein and fat in nuts can be excellently assimilated, but their place in the diet, like that of any other concentrated food, should be carefully regulated.

Any diet, to be normally propelled through the digestive canal, should possess a certain bulkiness; and for this reason nuts can be best used along with foods containing a large proportion of cellulose, as fruits, vegetables, breads, crackers, etc.

Always remember that they should constitute an integral part of the menu, and not to be superimposed on an already sufficient meal.

It is told of a Georgia merchant that, on a recent trip to New York, he was wine and dined at frequent intervals during the day and night by some of his commercial friends. Under the seductive influence of tempting viands, good fellowship, and sundry mixed drinks, he taxed his stomach to a wonderful degree, and just before retiring he partook of a small bunch of grapes. In a few hours the pains of an outraged digestive apparatus forced him to call in a physician, whom he gravely informed that some "*grapes*," eaten the night before, seemed to actually poison him.

The moral is obvious.

The thorough mastication of nuts is also essential, the co-efficient of digestibility being increased, and the liability to discomfort being decreased by care in this particular.

The popular belief that salt added to nuts makes their digestion easier is not borne out by investigation, though, to many persons, salt renders them more palatable.

The limits of this paper will not permit me to enter into details regarding the specific uses of nuts and nut preparations in varying conditions of human need. Their nutritious qualities have been utilized by numerous institutions and individuals in the building up of wasted and impoverished tissues; their charming flavors have enabled the confectioners to incorporate nuts in many of the delicious sweetmeats so alluring to the maiden's heart; while the housewife and caterer have found them invaluable in the preparation of countless dainty dishes.

Let me in conclusion stress the fact that the vegetable proteins are free from many of the poisonous products with which the flesh foods abound, and that they less rapidly undergo putrefactive changes in the intestines. Moreover, some of the purest and most readily digestible forms of fat are those derived from nuts, being provided as butter oils, or in the emulsified forms as nut butters.

People vary in their food requirements, as do stoves, furnaces or locomotives in their fuel requirements, and in our efforts to furnish the units of heat and energy needed to keep our bodily furnaces stoked and in running order, we should look with favor upon this nutritious class of food products, which nature has so cheaply and bountifully placed within our reach, and whose good qualities have been so scantily appreciated.

Permit me, therefore, to commend to you the study of nuts and their food value, believing this subject entirely worthy of your sober consideration.

Col. WADE: I would like to ask the Doctor if it is not true that sufficient prussic acid is contained in the nut or kernel of peaches to produce death?

Dr. NILES: There is just enough to flavor the nut. It is a flavor that is very permeating, just as if you took a drop of kerosene oil and put it in a barrel of flour. There is very little of the acid to be found in these nuts, and I do not think it sufficient to produce poison.

Col. WADE: The reason I asked the question was because I tried it on a pig, and it died.

Dr. NILES: How long did it live?

Col. WADE: For several weeks.

Dr. NILES: This acid is an instantaneous poison, and when it acts at all it acts at once.

Col. BRACKETT: I do not know that I have any question to ask on this subject, but I wish to say that this is a most excellent paper and I do not feel like going away without commending the paper for the consideration of everyone. While at the Chicago Exposition in 1893, I met a man there who was an Englishman. He told me he had lived four years on nothing but nuts and fruits, and he was a perfect specimen of health when I saw him. He took out from his pocket a little tin box about the size of a blacking box and showed me what his lunch consisted of. It was nut meats and fruits, and he ate nothing else. I do not think it would be advisable for a man to undertake to live entirely on nuts. Fruits should go with it, and I think it is one of the most healthy foods that a man can live on, if it is properly managed. We know that the Indians in certain parts of the country live almost entirely on the nuts of the pine tree. There are certain varieties of the pine tree which produce nuts that are used as foods, and we find that there is a perfect digestion of the nuts when they are properly masticated.

Col. FORT: I have no question to ask, but my father, who was one of the pioneers in Georgia, told me that in his early days he happened to be stopping at an Indian wigwam, and he noticed the Indian squaw picking the kernels from some hickory nuts. Upon inquiry he found that the Indians made a kind of soup from these nuts, which was very palatable and nutritious, this soup constituting their entire dinner.

Mr. VON HERFF: There is one question I wish to ask, which, however, has nothing to do with the nutritious value of nuts, and it is this: Perhaps the best known nut, called the English walnut, is largely grown in California; I am frequently asked by culturists and others why it is not grown in the East. My answer always was that it *was* grown in the East, but I have found that it is seldom that I find an English walnut in the East, and if I do it is a very small tree; in fact it is hardly grown there. Why is the English walnut, the most popular nut, not grown in this country east of the Rocky Mountains?

The PRESIDENT: I will ask Prof. Miller to answer that question.

Prof. MILLER: We have scattering trees of English walnuts from middle Alabama, perhaps from the Florida line, to New York State; but there seem to be some troubles to overcome, and recent experiments have been made by grafting the English walnut upon the black native stock, with the hope of more success. I have heard from parties in South Carolina who have had considerable success by grafting these trees for a number of years on black stock, but I think that possibly one of the greatest troubles in the Southern part of the country is the tendency of what we call "winter kill."

Col. FORT: We have had some practical experience with the English walnut in Southwest Georgia. Twenty years ago, before the pecan was ever budded, I planted an orchard of pecans, and included among them probably a hundred English walnuts. Two or three of those trees are living yet, and as Prof. Miller has just said, "winter

killing" is their greatest enemy. They are killed in the winter, and can not be grown successfully in the altitude of Southwest Georgia. I put them in with great care, and at one time had as many as a dozen or so trees growing, but never had any success with them.

Mr. VON HERFF: It would seem, however, that it is not a question of too much cold, for in California it is one of the most common trees that you see along the roadways everywhere, and that climate, I am sure, is equally as severe as Southwest Georgia.

Col. FORT: What we call the English walnut is grown to a very limited extent here, and for some climatic causes they are not a success. I remember seeing up in Putnam county a large tree at the residence of Mrs. Cobb. I have climbed up that tree as a boy and pulled off some English walnuts.

Prof. MILLER: It is not the severity of the cold, but the irregularity of our seasons, that produces this "winter killing." A warm spell with moisture in the soil will induce growth, and a very slight amount of cold below freezing point will kill an English walnut. It will even kill a pecan, if it is in growing condition when the cold strikes it.

The PRESIDENT: I thank Dr. Niles for bringing this subject before us for discussion. The next subject in order is "Apple Insects; Their Life History and Remedies," by Mr. A. C. Lewis, our Assistant State Entomologist, of Atlanta. He desires to leave this afternoon, and therefore asks the privilege of appearing before you now.

## APPLE INSECTS.

By A. C. Lewis, Assistant State Entomologist.

Apple growing is fast becoming one of Georgia's great fruit industries, and now while it is in its infancy is a good time to call attention to some of the most common apple insects. In Michigan, New York and other old apple growing States, they have found out by dear experience that they cannot grow apples successfully without spraying. While it is true that we do not yet have as many apple insects to contend with as the older apple growing States, we have enough to make it worth while to carefully fight those we have.

The apple grower in Georgia, whether he has few or many trees, will find that it will pay him well to watch out for and to fight the following: Apple Tree Borers, Woolly Aphis, Green Apple Leaf Aphis, and Codling Moth. These we will briefly consider in the order mentioned.

### I.

#### APPLE TREE BORERS.

(*Saperda candida* Fab.) (*Chrysobothris femorata* Fab.)

A common injury to apple trees is that caused by borers in the main trunk at or near the surface of the ground. There are two such borers that are common on apple trees in this State, the Round and Flat headed. They both work in about the same way; that is, in the sap wood just beneath the bark. The round headed borer works mainly on the trunk, usually at or near the ground, while the flat headed borer inhabits all parts of a tree from the trunk to the limbs, and shows a decided preference for diseased trees. It takes three years for the round headed borer to complete its life cycle, while the flat headed borer completes its growth in one year. The adults of both appear about the same time in the spring, during May and June.

#### METHODS OF CONTROL.

**Preventives.** For both of these borers the same preventives may be used. Wrapping the trunk with several thicknesses of newspaper, or other tarred paper, has given very good results. Instead of the newspaper, wire gauze may be used. Whatever is used should extend up the trunk about two feet and be covered at the base with earth and securely tied at the top. The wire or paper should be put in place in May and not removed until after September 1st. It is also well to

use above or in connection with these bands some good deterrent caustic wash. Whatever wash is used should be applied thoroughly every two or four weeks until three applications have been made. It must be remembered that these coverings and washes act only as preventives, and that some borers will get in the trees in spite of them, and so all trees should be wormed.

After the borer has entered the tree, about the only thing to do is to cut them out. A great many substances have been used to kill the borers in the trees, but none have given very good results. About the best substance so far recommended for this purpose is kerosene. Mr. T. B. Ashton, a correspondent of the Bureau of Plant Industry, says he has used kerosene with success. The kerosene is applied to the castings of the larvae that are protruding through the bark. The castings absorb the kerosene until it comes in contact with the larvae, killing them. Some kill the borers by probing with a sharp wire. All this work should be done in September and October.

### THE APPLE WOOLLY APHIS.

(*Schizoneura lanigera* Hauss.)

This plant louse attacks the roots of the apple, and also the limbs. Its presence on the roots causes galls, and even on the limbs small galls are produced. This plant louse, like others, secures its food by sucking the sap from the plant by means of a slender proboscis. This irritation and possibly a poison injected into the plant produces the galls. As the galls increase in size and numbers, the roots soon begin to decay. This rotting of the roots and plant food taken up by the lice are a great drain on the vitality of the tree attacked, and soon result in a sickly, dwarfed growth of the tree.

**Life History.** The life history of the Woolly Aphis in short is as follows: Beginning with the form occurring on the roots in mid-summer, we have wingless, agamic females, capable of giving birth to living young at the rate of two to twenty per day. This form continues until late in the season, when a few winged, agamic females are produced. These migrate from the roots of the tree where they were born to the limbs of that or other trees in the orchard, and thus they are spread from tree to tree. The offspring from these winged, agamic females are true males and females. The true female develops one solitary egg which, in the spring, hatches into an agamic female like the one we started with in mid-summer. The agamic females are present throughout the year in Georgia. We have never found the eggs, but it is probable that they exist, though their presence is not necessary for the propagation of the species from year to year in this mild climate.

## REMEDIAL MEASURES.

The old standard remedy for the Woolly Aphis was tobacco dust. In 1905 and 1906 the Georgia State Board of Entomology carried on experiments with different substances to determine which would be the most effective remedy for this insect. From these experiments it was determined that kerosene emulsion was the most effective substance used. The results of these experiments were published in detail in Bulletin No. 23, so I will only consider them briefly here. The substances tested were tobacco stems, kainit, kainit and tobacco dust, Tobacco decoction, common salt, whale oil soap, tobacco potash whale oil soap, carbon bi-sulphide, and kerosene emulsion. The results from the tobacco dust treatment were very poor as a whole; the kainit had no effect whatever on the Aphis. None of the other substances tested gave as good results as the kerosene emulsion. The kerosene emulsion was tested at 10, 15, 20, 30 and 40 per cent. In each case it gave very good results. For general use we recommend the 15 per cent. solution.

In treating trees with kerosene emulsion the soil should be removed to a depth of two or three inches in a circle from two to six feet, according to the size of the tree. To this enough solution should be applied to saturate the soil to a depth of two inches. After treatment, the soil should be replaced. In the experiments it was found that the odor of the kerosene remained in the soil for several months. Thus it will be seen that kerosene not only kills the insects it touches, but acts as a repellant and keeps the Aphis from returning to the treated roots.

## GREEN APPLE LEAF APHIS.

(*Aphis pomi* DeGeer.)

The Green Apple Leaf Aphis is very common in Georgia, and frequently does a great deal of damage to young apple trees. They attack the tender growth, causing the leaves to curl, and blacken, and maybe die. The curling of the leaf is caused by the aphis sucking the sap from the under side of the leaf. While the tree is not killed by the aphis, the growth is greatly retarded and the limbs distorted.

We will not give the life history of this aphis in full. The winter is passed in the egg. The eggs hatch in the spring into agamic females or, as they are called, "stem mothers," which give birth to living young. The first generation matures in about fifteen days; the following generations in eight or nine days.

In the second and third generations a few winged forms appear, and these are the migratory ones that spread the aphis from one tree to another. One peculiarity of this aphis is that the young of the winged forms mature without wings. Throughout the summer this aphis continues to produce agamic females until the last generation in

the fall, when we have the true males and females. After mating the females deposit eggs which remain on the trees over winter, and hatch the next spring into "stem mothers."

#### REMEDIAL MEASURES.

This aphid can be controlled very easily by spraying, if the spraying is begun in time; that is, before the leaves curl. After the leaves have curled, it is much more difficult to reach the insects with the solution.

I have successfully killed this aphid with all the following preparations: Whale oil soap solution (1 lb. to 3 gals. of water), kerosene emulsion (15 per cent.), and tobacco decoction (3 lbs. to 5 gallons of water, boiling for two hours).

For the beginner in spraying I would advise the tobacco decoction, as it is easy to prepare and it will not injure the trees. The limbs of small trees may be dipped into this solution without fear of harming them.

Remember, when spraying for this aphid, that the solution must touch the insect to kill it. For this reason it is well when spraying to use an extension rod with an elbow, so that the spray can be directed on the under side of the leaves.

#### THE CODLING MOTH.

The Codling Moth is the most harmful insect that apple growers in Georgia have to contend with. It causes many apples to drop off before they are large enough to be worth anything, and many more drop prematurely, or are wormy and rot soon after gathering.

**\*Life History.** The Codling Moth passes the winter in the larval stage in cocoons. The larvae change to pupae at the approach of warm weather, and emerge as moths soon after the apples bloom in the spring. Four or five days after emerging, the moths lay their first eggs. According to observations made by W. V. Reed, 86 per cent. of the eggs are deposited on the upper surface of the leaves, 9 per cent. on the fruit, 3 per cent. on the lower surface of the leaves, and less than 1 per cent. on the twigs. The length of the egg stage varies from eight to ten days in the early spring to five or six days in mid-summer.

**Larvae.** Soon after hatching, the larvae begin feeding on what is at hand until they find an apple. 74 per cent. of the worms enter the apple at the calyx, 16 per cent. at the side, and 8 per cent. at the stem, according to observations made by W. V. Reed.

The time spent in the fruit by the larvae varies from 17 to 41 days for the first brood; in July the time was from 13 to 36 days; for the season, the average was about 24 days.

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\*The life history as outlined in this paper is based upon observations made by W. V. Reed, and published in Bulletin No. 29 of the Georgia State Board of Entomology.

From 7 to 13 days elapse after the larva enters the cocoon before it emerges as a moth. The moth lives from one to three weeks.

The time of the life cycle of the moth varies from 35 to 65 days, or an average of about seven weeks. In 1908, three and a part of the fourth generation were observed.

**Spraying for Codling Moth.** To determine when and how often to spray for the Codling Moth, a great many experiments have been conducted throughout the Union. In the West, (Colorado), they claim one drenching spray is sufficient, but in the East they usually advocate two or three sprayings. To determine these and other points of interest, spraying experiments were conducted in 1907-08-09 by W. V. Reed, of the Georgia State Board of Entomology. The results of the experiments of 1907-08 were published in Bulletin No. 29, a copy of which may be secured by writing E. L. Worsham, State Entomologist, Atlanta, Ga. The results given in this paper were taken from this bulletin. Without going into the details, I will give the results in a general way.

The spray used was the Arsenical Bordeaux mixture, consisting of 6 lbs. of lime, 3 lbs. of bluestone and 2 lbs. of Disparene, to 50 gallons of water.

In all, nine plats were sprayed and one to four applications were made at different dates. One early spraying, April 13, gave from 84 to 90 per cent. of uninfested fruit; one later spraying gave from 33 to 50 per cent. of uninfested fruit. On check plats 32 to 48 per cent. of the fruit was uninfested.

Two early sprayings, April 6th and 13th, gave 88 to 90 per cent. of uninfested fruit; while two late sprayings, June 12th and 26th, gave only 37 to 51 per cent. of uninfested fruit. The best results were secured from three applications, two early, April 13th and 27th; and one late, June 12th; this giving from 96 to 97 per cent. of uninfested fruit.

**General Benefits of Spraying.** Spraying with the arsenical Bordeaux not only controls the Codling Moth, but also reduces the injury from fungus diseases, such as leaf spot, apple scab and bitter rot.

While the results from the use of arsenical Bordeaux are beneficial as a whole, it may in some cases injure the fruit if not properly made, or applied too strong. As a rule it is not safe to use more than three pounds of bluestone to fifty gallons of water, and even then in a very wet season, like the present one, it may produce some injury.

In Mr. W. V. Reed's experiments this season three sprayings did considerable damage to the fruit and foliage. To avoid this damage in a season like this, it would be well not to make more than two applications of the arsenical Bordeaux solution, and for the third spraying use only two pounds of Disparene and three pounds of lime to fifty gallons of water.

To close this article I cannot do better than give the summary and recommendations as given in Bulletin No. 29, by W. V. Reed:

**"Summary and Recommendations.** The first or hibernating moths make their appearance in from ten days to two weeks after the apples bloom in spring.

"86 per cent. of the eggs are laid on the upper surfaces of the leaves, and the young larvae in a great many cases are forced to subsist for several days by feeding on the leaves before they find an apple.

"About three-fourths of the larvae enter the fruit by way of the calyx end.

"Approximately seven weeks are consumed in the life cycle of the moth, and we have three and a part of a fourth generation or brood when spring comes early.

"Parasites and predaceous enemies of the moth are very active, and aid materially in holding the pest in check.

"The annual loss from the Codling Moth to the State is safely from 50 to 70 per cent. of the apple crop when spraying is not practiced.

"The time to apply the first spraying is just before the calyx closes. On the time and proper application of this spraying hangs 78 per cent. of the success in controlling the Codling Moth for the entire season.

"Two sprayings, the first applied just before the calyx closes and the second from seven to eight weeks later, when the second brood appears, give the best results from an economic standpoint, 90 per cent. of the fruit being protected.

"Late sprayings alone are of very little value and, unless preceded by spraying before the calyx closes, should not be attempted.

"Careful attention should be given to the spray operation. All parts of the tree should be thoroughly covered and the spray applied until it drops freely from the foliage. To do this most conveniently a high pressure should be maintained so as to secure a mist-like spray, and the nozzle should be turned at an angle so that the operator can direct the spray either upward or downward at his will.

"Banding even as an adjunct method of fighting the Codling Moth is a waste of time.

"Spraying costs a mere trifle as compared to the value of the crop protected from the Codling Moth."

The PRESIDENT: This paper of Mr. Lewis' will be printed in our proceedings and distributed, so that it will all be thoroughly explained to you, because it is a very difficult matter to take in all the points; and when you have it in print it is a much easier matter.

I will now introduce to you Prof. H. P. Stuckey of the Georgia Experiment Station, who will read you a paper on "Spraying to Control the Black Rot of Tomatoes."

## **SPRAYING TO CONTROL THE BLACK OR BLOSSOM-END ROT OF TOMATOES.**

By H. P. Stuckey, Horticulturist Georgia Experiment Station.

Mr. Chairman, Ladies and Gentlemen:

This Black or Blossom-end Rot is the most prevalent and destructive disease of the tomato. From its ravages in Alabama and South Carolina during the past five years, I have found that it often destroys fully two-thirds of the yield at a time when the crop is most valuable; that is, in the early part of the season. The plants of two unsprayed plats at the Georgia Experiment Station this season, which were entirely remote from the sprayed plats, failed to mature the first two settings of fruit owing to the attacks of this disease; and up to July 19th not a single fruit had reached maturity on either one of these plats. On the sprayed plats, which comprised practically one-fourth of an acre, five pickings were made previous to July 17th, giving a total yield of 2,254.35 pounds, of which 796.93 pounds were diseased. At the time this fruit was harvested, tomatoes were selling on the local market for an average of five cents per pound. This means a loss of \$34.84 per acre, even on the sprayed plats, for the first five pickings, up until July 17th, when the crop was scarcely more than half harvested.

### **(1) NATURE OF THE DISEASE.**

This disease usually appears on the young fruit shortly after the blossoms shed, and is generally much worse on the first setting of fruit than on the fruit of the same plants which mature later in the season. As a rule, it attacks the blossom-end of the young fruit in the form of a small, roundish, somewhat shrunken and slightly shriveled, brownish-black spot. The area of the diseased spot increases in size until practically the whole fruit is rotten. Sometimes the spread of the diseased spot is more rapid than the growth of the tomato, in which case the fruit often decays before it reaches one-fourth full size, while in other cases the decay is slow and the tomato reaches almost full size and ripens prematurely with a rotten end.

### **(2) CAUSE OF THE DISEASE.**

The cause of this disease, according to Prof. F. S. Earle (formerly of the Alabama Experiment Station, in Bulletin 108 of that station),

is a bacterium, often accompanied by a fungus. He further stated that the disease is probably transmitted by insects. I also am inclined towards this theory of insect transmission, for when I inoculated the fruit by means of a needle, the disease was found to be infectious.

### (3) THE EXPERIMENT.

Working upon this hypothesis, I planned an experiment to ascertain whether or not a fungicide combined with an insecticide would have any effect in holding this disease in check.

Five standard varieties of tomatoes were selected, as follows: Chalk's Early Jewel, Livingston's Beauty, Majestic, Prize Bell, and Spark's Earliana. The seeds were sown on benches in the green house February 23rd. The plants were set in the open field April 12th, and given a distance of four feet between the rows, and three feet between the plants in the row. Each row had an application of twenty pounds of a complete fertilizer, analyzing 7 per cent. phosphoric acid, 4 per cent. nitrogen, and 6 per cent. potash, and then received ordinary culture such as is required for tomatoes. There were three rows of each variety, except the Majestic, extending across an acre of ground. This area was divided into four plats, each plat extending across the rows and taking in sections or each variety.

#### THE SPRAYING.

Plat No. 1 was sprayed with a formula as follows:

Formalin, 40 per cent. solution.....	1 pint.
Unslaked lime ....	11 pounds
Nicotine . . . . .	1 pint
Paris Green . . . . .	11 ounces
Water . . . . .	110 gallons

Plat No. 2 with a formula as follows:

Copper Sulphate . . . . .	8 pounds
Unslaked Lime . . . . .	10 pounds
Paris Green . . . . .	10 ounces
Water . . . . .	100 gallons

Plat No. 3 left blank,—not sprayed

Plat No. 4 was sprayed with a formula as follows:

Copper Carbonate . . . . .	10 ounces
Strong Ammonia . . . . .	5 pints
Paris Green . . . . .	10 ounces
Nicotine . . . . .	1-4 pint
Water . . . . .	100 gallons

Four sprayings were given each plat with its respective formula as above outlined, and in every case each formula was applied the same day. The first spraying was given May 12th, when the plants had just

begun to bloom; the second was given May 27th; the third, June 5th; and the fourth, June 30th. When the fourth spraying was given, quite a large per cent. of the fruit had begun to ripen. Thus the Paris Green in the spray solutions at this application was omitted.

A very small per cent. of the first fruit which set on all the varieties was affected with the rot. The disease was more apparent, however, with the second setting of fruit. A slight infection had occurred on all the plats and varieties by June 7th (the records for this season show that the five varieties above mentioned are about equally susceptible to the disease).

#### TABLE SHOWING RESULTS OF THE EXPERIMENT.

The following table is self-explanatory, and gives the most important results of the experiment

Plat No.	No. Pickings.	Spray Solution.	No. Spray Applications.	% Good Fruit.	% Diseased Fruit.
1	5	Formalin			
2	5	Nicotine mix.	4	62	38
3	5	Bordeaux mix.	4	68	32
4	5	Blank.	0	58.3	47.7
		Ammo. cop. carbonate	4	66	34

#### DISCUSSION OF THE TABLE.

It will be noticed from the table that spraying with Bordeaux mixture gave the best results; the ammonia copper carbonate mixture gave second best, while the formalin-nicotine solution gave the poorest results, and stood near no spraying at all.

While experiments for any one season would not settle a question of this kind, and while the results shown in the table, as a whole, seem rather poor, this experiment indicates that spraying has some effect in holding this disease in check. If this disease is transmitted by any insect or class of insects, it is possible that the sprayed plats were effective in checking the infection on the unsprayed plat, for the spray mixtures used were combined insecticides and fungicides, and may have reduced the number of insects carrying the disease.

#### SUMMING UP RESULTS OF THE EXPERIMENT.

In summing up the results of the experiment, we might say that this one season's work indicates that spraying with Bordeaux mixture combined with Paris Green gives two-thirds perfect fruit. But whether this disease is to be controlled by spraying, by systematic methods of crop rotations and culture, or by breeding resistant varieties or strains of varieties, is yet to be determined. However, let us join our forces and give each other the benefit of our observations in trying to work out methods for the control of this disease, which is so destructive to the early crop of tomatoes and which means so much to the gardener and truck farmer.

Col. FORT: I have not had much experience with tomatoes, but I would like to say that I had a very intelligent, cultured Athens lady visiting me about a week ago. She is a fine gardener, and she went out to look at my patch of tomatoes. My boys were picking some fruit, and they spoke of being troubled with this black rot, causing them to have to throw away a great many of the tomatoes. "Why," she said, "that is a very simple matter." She said it was the struggle of the plant to burst the bloom at the blossom end, which gets some fungus in there and starts a rot. She said, "Just take your finger and rub that off." This was four days ago, and I only suggest this for your experiment.

Prof. DeLOACH: Mr. Stuckey, have you tried putting sacks around flowers to keep insects off them?

Prof. STUCKEY: No, not yet. We wanted to see if we could get up a fungicide which would control the disease. We see now that we did not succeed in this, so next year we hope to take up your suggestion.

Prof. DeLOACH: Of course that would be a very easy experiment to try. I saved several tomatoes that way myself last year; I think one or two had the rot, but as a general rule the tomatoes developed very well. I would say for the benefit of Col. Fort that the flower is not responsible for the rot, although I think the disease is transferable.

Prof. McHATTON: Prof. Stuckey mentioned that it was a bacterium. I noticed this infection last year, and I attributed it to the black rot, which I studied at school as that disease. I ran across a Bulletin of Prof. Earle

of Alabama, on this subject, and I went out to see if I could bear out Prof. Earle's investigation and discover a bacterium from which I got an inoculation on other tomatoes. I also found associated with this tomato the fungus that Prof. Stuckey has mentioned. This disease looks in a great many ways like the common black rot, and you will always find the bacteria in connection with it. Whether the insects transmit it or not I was unable to determine.

Col. MORRILL: I would ask if you do not almost invariably find worms in these tomatoes?

Prof. STUCKEY: No, sir; we do not. The worms will get in one side and the disease on the other. But it does not necessarily follow that worms are the cause of the rot; in fact, I think we can safely state that that is not the cause.

Mr. MERRIAM: I would like to ask Prof. Stuckey what crop was on this land the year before?

Prof. STUCKEY: Strawberries.

Mr. MERRIAM: Had they been fertilized with stable manure?

Prof. STUCKEY: No, we used cottonseed meal.

Mr. MERRIAM: The reason for my inquiry was, that I find where stable manure is used, the plants are much more likely to be affected by this black rot, and for that reason I have used commercial fertilizers altogether in recent years.

The PRESIDENT: We have now come to an article we are all very much interested in, "Market Gardening,"

by F. J. Merriam, Editor of the Southern Ruralist, Atlanta, Ga., whom I now introduce to you.

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## TRUCK FARMING.

Address by F. J. Merriam.

The industry known as truck farming has undergone an enormous development in the past fifteen or twenty years. Formerly our large cities were almost wholly dependent upon the local market gardener, and vegetables were grown extensively under glass during the winter. Of late years, however, this winter trade has been supplied by the truckers in Florida, Texas, and along the Gulf Coast who, with the aid of refrigerating cars, fast freight and express, have been able to put vegetables on the Northern markets in immense quantities, and much cheaper than they can be grown locally at this season. And now the local trucker must confine himself more to staple rather than fancy lines, and finds his principal market limited to the summer months.

### CLASSES.

You will observe that the trucking industry easily separates itself into two classes: The local trucker and the shipper. For the local gardener the proximity of a large city is of supreme importance when selecting a location, as the people who eat vegetables but do not grow them must supply his market.

Land fairly well suited for vegetables can be found near almost any large city, and the farm should not be more than ten miles distant at the outside; and the nearer the better.

Naturally, land near any large city is high in price, but the first cost is of small importance as compared to the character and fertility of the soil. Necessarily, in growing vegetables, rich land is needed and very large quantities of manure and fertilizer must be used; and you can purchase fertility cheaper already in the soil by buying rich land, than you can by buying manure and fertilizer to make poor land rich.

When I first went into the trucking business near Atlanta, I took hold of an old run-down farm and we had an up-hill fight for several years before we got our land in condition where it would make a maximum crop. Our books will show that where we only sold \$600.00 worth of vegetables the first year, the fourth year our receipts ran over \$4,000.00, and, one year, over \$6,000.00. Out of this we had our living, paid our expenses, and realized from \$1,000.00 to \$1,500.00 net profit besides.



be especially well adapted. Thus, while celery is grown principally around Sanford, Fla., at Hastings, Fla., the main vegetable crop is Irish potatoes. These potato growers have done wonderfully well; over 120,000 barrels have been shipped this year, and sold at an average of over \$6.00 per barrel.

At McIntosh, Fla., over thirty carloads of lettuce were shipped this year, and sold at \$3.00 per basket.

At Winter Garden and Miami, Fla., the tomato growers realized large returns, obtaining from \$2.00 to \$3.00 per crate for their tomatoes, cash at their railway station. Peters & Son, at Miami, have over 200 acres in tomatoes. These people are riding in automobiles this year, and next year they may be at their wits' end to meet running expenses, as they were a few years ago.

#### ONION GROWING IN TEXAS.

Some twelve or fourteen years ago Mr. T. C. Nye of Laredo, Texas, bought a ten cent package of Bermuda onion seed and planted it; and from that small beginning has developed one of the largest items in the truck growing business in the United States. The section in which this experiment was made proved to be favorable in all respects for the growth of the Bermuda onion, and there are now shipped each year from Southwestern Texas between twelve and fifteen hundred cars. During the early years of the business the profits made by some of the growers were tremendous; a net profit of over \$20,000.00 from a 40-acre crop is one instance of the money that was made in this business, and, naturally, this led to over-planting, speculation and losses. The men who have grown Bermuda onions in a conservative, business-like way have made money steadily, even during years when reckless over-planting and still more reckless methods of marketing brought disaster to many of the growers. The past season, for instance, saw a crop of probably 1,300 cars produced in Southwestern Texas. The selling organization which the growers have built up has been unwisely managed and to an outsider, at least, it appears as though there were very serious mistakes in judgment and some very questionable methods used by the manager in charge of this selling organization. Nevertheless, Mr. Nye, who grows and sells his crop independently and in a strictly business-like manner, realized over \$7,000.00 from his 20-acre crop. Some of his neighbors, who followed his methods and sold their crops in a "safe and sane" manner, realized good profits and are now making their plans for putting in seed for another crop, while others, who stayed by their organization and refused to recognize and correct the serious mistakes that this organization has been making, have not realized any profit from their 1909 crops.

Influential men among the growers are taking hold of the matter vigorously, however, and from present indications the business will be

put on a solid and honest foundation so far as the selling of the crop is concerned during the coming year; and, if this is done, it can safely be predicted that the profits of the business will be both large and sure in future years. There has been no question whatever in the world, and there is no question, as to the demand all over the country for this most delicious variety of onions; but the growers have most unfortunately been misled and tricked by those whom they trusted, and who held positions of responsibility in the business of disposing of their crops. When this error is corrected, as it will undoubtedly be, the onion growers of Southwestern Texas will find themselves in possession of a magnificent business, which will return steady and splendid profits.

Before this business was developed in Texas, the chief supply of Bermuda onions was grown in the Island of Bermuda, and from this fact the onion received its name, although it really ought to be called the Canary onion, from the fact that it is a native of the Canary Islands and the seed must be imported from there every year. With the growth of the business in Texas, however, the profits of the Bermuda Island growers have steadily diminished and they have practically given up the growing of the crop, as Texas has shown that she can produce better onions at a lower price, and in quantities far surpassing anything that the Bermuda Island growers ever dreamed of.

This business has also become established in Southern California, and the cantaloupe growers of the Coachella Valley in that State are now onion growers as well. Probably 150 carloads of onions were produced in that section last year, and there seems to be promise of a large development along this line for that section. When our fleet of battleships anchored in San Francisco Bay last year and began taking on supplies for their long Pacific cruise, carload after carload of these California Bermuda onions were stacked away in the storerooms of these great ships, and the trail of the fleet across the Pacific was doubtless marked, not only from the smoke of the great funnels and the echoes from the guns, but also by the perfume of the Bermuda onion as it mingled with the soft breezes of the tropics.

And so we find different special lines of truck farming flourishing in different localities, and while the local trucker must grow a larger variety to supply his trade, even here we find that some gardeners succeed better with certain vegetables than others, and I am convinced that the largest profit will come along special lines.

Georgia is not noted as a trucking state, although our watermelons and cantaloupes have found their place on the market, and strawberry growing is developing in South Georgia. I am convinced, however, that the possibilities for truck farming in our state are great, though at present undeveloped. This is especially true of the extreme northern portion of the state, where late potatoes, tomatoes and cabbage can be grown to advantage to ship south; also strawberries and raspberries.

In South Georgia early Irish and sweet potatoes can be grown with profit; also cabbage, tomatoes and onions. Still, the larger profits from truck farming will always be realized in those localities where vegetables may be produced when there is the greatest demand in our big cities, and where rapid and direct transportation may be secured. In fact, it will never pay to go into truck farming anywhere unless you are near a large city or have good transportation facilities.

Mr. MORRILL: I know a man in Bibb county, a Mr. Clark, who has made 1,600 bushels of Irish potatoes off eight acres, and sold them for \$1.25 a bushel; he then put it in watermelons and sold five carloads of watermelons. Mr. Clark is a fine farmer, and he has been growing the Bliss Triumph for many years.

The PRESIDENT: A man near Augusta, who planted the Lookout Mountain in August, has raised as large a crop as you have just stated.

Prof. SNELLING: I would like to ask if this potato is planted about this time in August, what time does it mature?

The PRESIDENT: Just before frost.

Col. WADE: They mature in November at Cornelia.

Mr. MERRIAM: I would like to say in regard to that Lookout Mountain potato, that I have had good success with it, and made in fact 300 bushels to the acre. Mr. Brown of Smyrna, Ga., has done very nicely with it. He has his potatoes put up now in good shape, but these potatoes never do entirely mature; they simply keep on growing until frost kills the vines, when we dig them. Of course, the later the frost keeps off, the more potatoes we can make. If we have good seasons it is a wonderful potato.

Prof. SNELLING: If I put them in within a week, will they mature?

Mr. MERRIAM: They ought to be planted by the 15th or 20th of July. Still, you can plant them in August and then make some potatoes; but they won't do as well.

The SECRETARY: I would like to announce the Committees that have been appointed by the Chair. They are as follows:

Committee on Fruits and Vegetable Exhibits—Col. G. B. Brackett, Washington, D. C.; Prof. T. H. McHatton, Athens, Ga.; Prof. H. K. Miller, Monticello, Ga.

Committee on Treasurer's Account—Col. John P. Fort, Athens, Ga.; L. L. McClesky, Atlanta, Ga.

Committee on Resolutions—B. W. Hunt, Eatonton, Ga.; H. E. Waernicke, Washington, D. C.; B. Von Herff, New York City.

The PRESIDENT: I will now introduce to you Prof. H. K. Miller, who will read a paper on "Opportunities for Pecan Culture in the Southeast."

## OPPORTUNITIES FOR PECAN CULTURE IN THE SOUTHEAST.

By Prof. H. K. Miller, Monticello, Ga.

In this day of progress, which has seen a re-adjustment of economic conditions, the effects of which may prove far-reaching and of the utmost concern to the producers of our land, it is well to take notice of the trend of affairs in order to master new situations as they arise. One of the prevailing tendencies is that of the relative advance in the cost of food products. We are confronted with the fact that the cost of living is increasing at a rate which is proving serious to some classes of society. On the other hand, division of labor has enabled many

to arrive at a fairly independent station of life, with ample means to gratify their wishes as to the kind and quality of food they desire. It is this class which creates markets for new and special food preparations. In many instances, the new foods introduced have not only proved palatable, but are highly nutritious and occupy an important place in the dietary. Among these, few are more important than nut meat products. There is a constantly increasing class who insist upon the use of nuts as a partial substitute for animal products, which have attained almost prohibitive prices, so that the demand for nut meats is sure to increase with rapidity.

One of these meat substitutes which deserves the attention of Southeastern horticulturists is the pecan nut. The investigations of Wood and Merrill show the food value of a pound of pecan meats to be equivalent to 3,445 calories. From this it appears that a pound of pecan meats lacks only 55 calories of being sufficient to supply the daily requirements of the average man. Attention is called to this fact to show that pecans have a real food value, and are not to be regarded merely as confectionery.

The consumption of nuts has increased steadily during the past ten years, and will continue. Not only do we consume practically all of the home production, but we import between six and seven millions of dollars worth of nuts per year. Of all nuts used for table purposes, there is none superior to the pecan. The pecan of commerce is obtained chiefly from native trees of Texas and the lower Mississippi Valley. It is needless to say that these are quite inferior to the improved kinds which now bear varietal names, these commanding a price from four to ten times that paid for the ordinary nuts.

For a quarter of a century a number of growers have been experimenting to ascertain the possibilities for growing pecans under cultured conditions. Seedling trees were first tried, but without sufficient success to warrant large investment. This was due to the inferior quality of the nuts, the lack of uniformity both in size and quality, irregular fruiting of the trees, and the long time required for the trees to come into bearing. That orchards of seedling trees, favorably located and properly attended, would ultimately prove profitable cannot be denied. The hundreds of old trees in numerous localities throughout the South, attest in no mistaken terms to this fact; trees that have passed the quarter century mark in age. Many instances are known of single trees producing an annual return of \$25.00 to \$75.00, but in few of these cases do these returns benefit the one who thoughtfully, perhaps hopefully, planted the seeds years ago.

For commercial purposes we must be able to secure returns within a reasonable time. It has been pointed out that it is chiefly the old men, without hope for personal reward save the satisfaction of benefiting posterity, who can afford to plant pecan trees. Such, however,

is not the fact. With the present state of our knowledge of pecan culture, we are assured that a long period need not intervene between planting an orchard and the time for profitable harvests. I would not have any one understand that the details of pecan culture are fully understood, but am prepared to affirm that sufficient information is available to enable one to intelligently undertake commercial pecan orcharding with assurance of success, in this section of our country.

It is not my purpose to give a detailed course to follow, but merely to mention a few items of importance.

The failure due to the use of seedling trees has largely been overcome by the introduction of varietal stock, viz., grafted or budded trees grown from scions taken from trees of known merit. By the use of such trees we tend to such uniformity of growth that it is possible to develop an orchard in which the trees will grow at approximately the same rate, a condition which seemed impossible with seedling trees. There is yet room for improvement, inasmuch as the stocks upon which the trees are grafted will, in a degree, determine the rate of growth, and, with further care in the selection of stocks, improvement is possible.

Grafted or budded trees will also induce more uniform fruitage, but in this case also the stock has considerable influence; it being frequently observed that under similar conditions some grafted trees are more prolific than others of the same variety. Early fruitage is another factor gained by the use of grafted trees, it being not at all uncommon for trees to begin fruiting at three years from planting, and, when anything like proper care is given, most varieties will fruit by the sixth year from planting, and will yield fair returns at the eighth to tenth year. As a rule, grafted stock is less subject to the influence of fungus diseases, being able to overcome their attacks on account of the vigorous growth they make. Some varieties, however, are easily affected, and such should be avoided.

Concerning the income to be derived from a pecan orchard at a given age, much depends upon the owner. It is entirely feasible for a 10-acre orchard to be made to average forty pounds per tree at the fifteenth year. I dare say some experienced growers will assert that this can easily be exceeded. With this as a basis and the nuts selling at 25c per pound, ten acres would give a gross income of \$1,700.00, or a net income of \$1,500.00, a sum which will support an average family in modest comfort, or supplement the income of one engaged in some active vocation, in a substantial degree.

Much has been said pro and con concerning the feasibility of producing pecans in Georgia, Florida and Alabama; some insisting that, because the pecan is native only to the river bottoms of the Mississippi and its tributaries, it is only there one can hope to have success. These lose sight of the fact that we are dealing with an unimproved

product, and that cultural methods are substituted for the natural wild conditions which prevail with the native trees of the river bottoms; that intelligent culture in all instances is superior to primitive conditions. But a few facts are worth more than many theories. The trick is being done in these states where properly cultivated orchards surpass any of similar age, in the so-called home of the pecan, that have come to my notice, both as to early fruitage and quality of nuts. The question admitted argument several years ago, but at this time there are too many young orchards in this section which demonstrate not only the feasibility of successful pecan culture, but the entire congeniality of soil and climate is established.

With orchards under ten years of age coming into bearing in a satisfactory manner, and with old trees here and there that have weathered the storms of half a century yielding heavy annual crops of superior nuts, yet apparently in their prime, can we for a moment doubt the feasibility of pecan culture in this state? It is true some judgment is required in the selection of an orchard site. Cold, wet lands that are sour, crawfish land, and such land as causes corn or cotton to "French," must be avoided.

Neglecting to observe these precautions has resulted in failures which must be accepted as danger signals for future guidance. A deep soil of good quality that will grow a fair crop of both corn and cotton can be depended upon as suitable for pecans.

Cultivation of the young orchard in a thorough manner is one of the greatest essentials. Pecan trees will not stand for neglect, but, on the other hand, resent such treatment. What the apple is to the North as a money crop may be duplicated in the South with the pecan; there being many points in favor of the latter. Earlier returns may be had from an apple orchard, but it is subject to more enemies than the pecan, is shorter lived, and requires greater care in growing and marketing the crops. The pecan crop is one of the few which may be harvested and marketed at leisure, an advantage fully appreciated by those engaged in growing perishable crops.

Pecan culture admirably adapts itself to three classes of growers: First, those who desire a few trees for home use, or for supplying local demand. It is to these that the greatest relative returns are available; due, primarily, to a personal care manifested in all phases from the selection of the trees to the final disposition of their products. It is not uncommon to find instances where a few door yard trees yield sufficient nuts for the family use and enough more to meet the annual state, county and city taxes on the home. It is under such circumstances that we see the pecan tree at its best. It delights in the home atmosphere, and there yields its harvest with a lavish hand.

In the next place, the pecan will abundantly reward the small orchardist who plants a few acres to supplement other farming opera-

tions. Under such conditions the orchards will thrive under the personal care that may be given in a measure impossible with large plantations. It is this class who may hope for the greatest returns proportionate to the investment and care rendered. The planter who establishes a private market for superior nuts derived from his well-tended ten or twenty acres will be the one to fully embrace the opportunities offered in this section by the culture of pecan trees.

Finally, the pecan is proving attractive to the large grower and the promotor for production on a large scale, and if there be any section or any product that can be combined to yield successfully to operations of this nature, surely pecan culture in this region has claim to first consideration.

Wildcat promotion, however, will only clog the wheel of progress. If experience with other large horticultural enterprises is of value, we can never hope to have abnormally high profits through projects of this kind, and the disappointments are sure to reflect adversely on the business founded on a false hope.

I believe the large orchards can be made to pay and pay handsomely, but it is idle to argue that a thousand acres will multiply the profits of an acre a thousandfold; of necessity the yield is proportionately less, and the cost of maintenance is likewise increased.

The PRESIDENT: Prof. Miller, you stated that some trees although grafted the same way, would not grow as thriftily as others, although of the same variety. That of course bears out the theory, as yet not very well defined or understood, that there must be an affinity between the graft and the stock to make it a complete success. Where that affinity exists we have not been able to find. All of us know that in selecting stocks to graft upon we usually select such stocks as have been grown from the thriftiest wildings, that have not greatly removed from the native type. For instance, the smallest seedlings sometimes make the best stocks. This refers to apples, peaches and pears; I would like to know if you have found this rule true as to pecans?

Prof. MILLER: Yes, sir, to a certain extent.

The PRÉSIDENT: Would there be any possibility of arriving at the cause?

Prof. MILLER: I do not know that it is possible. With seedling stocks we observe that the difference is very marked. Trees taken from nuts gathered in the same locality will manifest extreme difference in the seedlings that they produce. Some will start up a growth a month ahead of others similarly planted. Some will grow off thriftily even if they start out late, and will yet make good stocks. It is a common observation that the Texas seedlings do not make good stocks for this section of the country. Trees grafted on such stocks grow off much more slowly than they do on our native nut seedlings.

The PRESIDENT: Does the size of the nut make any difference?

Prof. MILLER: Large, solid nuts as a rule give better results.

The PRESIDENT: The pecan industry is yet in its infancy, and we are glad to have the results of Prof. Miller's observations; and I hope he will continue his work along this line and see what stocks are best to propagate upon.

Prof. MILLER: I think the greatest improvement to be made at the present time is to take our best varieties and graft them upon selected seedlings; that is, more observation is necessary as to the source of our seedlings.

The PRESIDENT: That rule is rather against what the acknowledged idea is. When you have a seedling

from a very greatly improved tree, it does not make actually as good a stock to propagate upon as when taken from a wilding. Now, you say the best stocks come from improved nuts?

Prof. MILLER: I did not mean nuts from grafted trees; I meant stocks taken from our native trees that show superior nuts, good, thrifty, well-filled, plump-meated pecans. Such seed as that from seedling trees grown in our own sections usually give better results than from seeds brought from a distance, and of a mixed nut.

Mr. HUNT: Is there any way of keeping pecans? Apples we can have 365 days in the year, but pecans, after three or four months, become rancid. Is there any way of preventing this?

Prof. MILLER: We have undertaken to can them and keep them out of contact with the air. The results of these experiments show that, theoretically, we are on the right line. We find certain varieties that have a very dense shell will keep as long as two years, and still be edible. There are two varieties, the Curtis and the Schley, that possess this quality in a marked degree.

Prof. DeLOACH: I wanted to ask Prof. Miller about his theory about boring holes in the pecan tree to make them bear fruit. I know my father has a good sized pecan orchard down in Bulloch county, and there were about a dozen trees in the orchard that never bore fruit after ten years, and the man from whom he got them told him to bore a hole in the tree. He bored all of the twelve trees, and I think two or three of them fruited the next year. I want to know if there is any scientific explanation of this, Professor?

Prof. MILLER: There seems to be something in it. The nearest I can get to the reason why the grafted tree bears better than the seedling, is primarily due to the injury, or union, and nothing more. We frequently see injured trees in the orchard begin to bear as a result of that injury, and nothing else; and there is an old accepted theory that driving nails in an apple tree will make it bear very much earlier than others. It causes some inflow of sap that gives it a bearing habit.

The PRESIDENT: I desire to announce that the first paper tomorrow morning will be "Hardy and Ornamental Plants in Middle Georgia," by Mr. B. W. Hunt, of Eatonton, Ga. That is an especially interesting paper to the ladies, relating to all the hardy ornamental plants that can be successfully cultivated in this section, and we hope we will have a large audience from the ladies tomorrow morning. Our session tomorrow will begin promptly at nine o'clock, as there is a great deal of work to be done. Tonight's session will be at 8:30, and will be devoted to a discussion of the fruit lists; some corrections have to be made, as well as a great many additions.

The meeting then adjourned until 8:30, and in the meantime members enjoyed a very pleasant trolley ride and barbecue, tendered by the city of Athens through Prof. McHatton of the Georgia State Agricultural College.

## EVENING SESSION, AUGUST 4th, 1909.

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The meeting was called to order by the President at 8:30 p. m.

The PRESIDENT: We have allotted this evening for the revision of the fruit lists. It is a matter that would properly take at least a week, and I regret that we have not enough of our fruit growers present to give us the aid that we need. It was therefore suggested by Col. Brackett, who, years ago, was Secretary when I was at the head of the American Pomological Society, to do as we did then, put it into the hands of a committee. Now, if the sense of the house is in favor of that, I would like to know what your wishes are?

Mr. VON HERFF: I believe it would be a very good idea to put that in the hands of a Committee, because they can deliberate on each variety and decide the matter, at the same time leaving it to be discussed at the next meeting.

The PRESIDENT: We know from experience that each member can only give information upon the few varieties grown in his locality.

Mr. HUNT: I would like to say, Mr. President, that I think more of our lists of fruits that are suitable to the mountain, middle and southern regions, than I do of any other publication that comes out in print. I turn to it several times a year and find out how the State Horticultural Society will stand on some peach or some grape, and then go back to see its prolificness, etc. I am very anxious indeed to have it revised up to date, and I think it

ought to be done every year; and I would like to make a motion that the President appoint a committee of five or more, at his leisure, he to be the Chariman of that Committee. At the same time, Mr. Von Herff's idea is good. I do not think we ought to cut off discussion. I think the President might ask our experience on certain things, and then I would like to put that motion, that a committee of five be appointed, of which the President shall be Chairman, to revise the fruit lists.

Seconded and carried.

The PRESIDENT: I have letters from several of our members who were on the program, sending their regrets that they could not be on hand. Today we have had to do the best we could with the papers we had before us. The first paper tomorrow morning will be "Hardy and Ornamental Plants," by Mr. Hunt, and the ladies have promised to come in full force. Then we will have "The Effect of Cross Pollination," by Prof. DeLoach, and "The Translocation of Plant Food," by Prof. Carroll. After that we have "Starting an Orchard," by Prof. McUatton; and we have with us Mr. Waernicke, representing the Southern Railway, and Prof. Ayres of the U. S. Department of Agriculture. Mr. Fleming will read us a paper on "The Benefits Which Have Been Derived From the Work of the Fruit Exchange." After that comes miscellaneous business, such things as the report of the Treasurer, report of committees, election of officers, selection of the place of meeting, resolutions, etc. Independent of that, we have the "Question Box"; that has always been a great help to our meetings, for anybody

who is too modest to come up before the audience can put a question in writing and submit it for discussion.

Col. HUNT: I suggest that we take up the question of a change in our annual meeting from August. It seems to be the opinion of most of the members with whom I have talked that, if we could change the date of our meeting to say the fourth Wednesday in January, and hereafter hold our meetings in the winter instead of summer, we would have a larger attendance, the shippers would not be worn out, and possibly the work of the Society would become more beneficial to the State by such a change. I therefore make a motion to that effect, so that it can be done. The motion is, that hereafter we shall meet on the fourth Wednesday in January, commencing in 1910.

Col. WADE: Those of us who have been attending these meetings for the last ten years have realized that we do not have a sufficient attendance in summer, and I am in favor of the motion.

Seconded and carried.

The PRESIDENT: I now introduce to you Col. G. B. Brackett, Pomologist of the U. S. Department of Agriculture, Washington, D. C., who will read you a paper on "The Possibilities of Apple Culture in Northern Georgia."

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## THE POSSIBILITIES OF APPLE GROWING IN NORTHERN GEORGIA,

By G. B. Brackett, Pomologist, Washington, D. C.

Apple growing in Northern Georgia has long been a subject for urgent investigation, While peach culture has certainly received its

share of attention from the Georgia Horticultural Society, apple growing in the State seems to have been much neglected.

It was long considered a doubtful question whether apples could be grown in this State from the fact that it was thought to be too far south. But not until recently, when experiments began to be tried in the more elevated portions of the State, was it actually demonstrated that apples can be grown with profit and with perfect success, provided a careful selection of varieties adapted to the localities be made, and also that modern methods of culture and marketing of fruit are followed.

The testimony and experience of such men as Messrs. H. R. Staight the P. J. Berckmans Co., J. C. Free, J. M. Boutelle, D H Heskett, and others who are veritable leaders in this enterprise, have shown conclusively that the growing of first-class apples in Georgia is no longer a doubtful question.

In getting into the more elevated lands the temperature is much cooler, and the climate compares favorably with that much further north.

At the last meeting of your Society, held at Cornelia a year ago, I was greatly surprised to see the splendid display of apples on exhibition that were grown in the northern part of your State. Having been appointed by your worthy President to judge the fruit, it gave me an excellent opportunity of acquainting myself with the varieties that are being grown, and also of getting a more intimate knowledge of some of the growers with whom I had previously corresponded, and many of whom had sent me specimens of fruit. All of this led me to more fully investigate the possibilities of apple growing in the section under consideration.

#### THE OUTLOOK.

In determining the range of fruit growing, there are certain elements that enter into the environment that are of great importance, such, for instance, as climate, soil, exposure, elevation, rainfall, air and water drainage, all of which are essential factors to be considered. All of these favorable conditions are found to exist in Northern Georgia. The soil is of rather loose, friable nature, containing all the elements of fertility for the production of high-grade apples. The elevation is relatively high, affording a comparatively long season of ripening, as well as a good air drainage, which in a measure makes the location comparatively free from the effects of the late spring frosts. These late frosts usually cause more damage to the fruit crop, taking the country over, than any other one thing. The loss from this source alone can hardly be over-estimated, amounting in the aggregate, for the whole country, to many millions of dollars.

The climate here, with the abundant rainfall, is highly favorable, we might say ideal, for growing apples.

Coupled with all these favorable conditions of soil, climate and all the necessities for successful apple growing, there is the added advantage of proximity to nearby markets north and south, and if need be, to points for export trade.

If a wise selection of locality is made with reference to good transportation facilities, and a careful selection of varieties be chosen that are adapted to environment, together with all other advantages mentioned, there is no good reason why apple growing in Northern Georgia should not successfully compete with other apple growing regions of the country. But, having arrived at the conclusion that the natural advantages of this section are favorable for the production of apples, it does not follow that they will grow there spontaneously without the aid of man.

This brings us to the business side of the proposition. Like all other enterprises, successful apple growing depends largely upon the man behind the project.

#### THE MAN.

In the first place, he should possess good common sense, especially good business qualifications. He should know how to use this sense in selecting a suitable location and the best site for his orchard, how to prepare the land, how to plant his trees, the best varieties to plant, when to plant, how to cultivate, the best cover crops to use, the best fertilizers, etc. He must know how to prune and to train his trees, and to protect them from rodents. He must be diligent in his efforts to guard against insect enemies and fungus diseases; he should know how to spray the trees, what he is spraying for, whether for insects or fungus and other diseases, and especially must he be up to date in modern methods of gathering, grading, packing and marketing the product. He may be able to grow as fine fruit as ever was grown, but if he does not know how to dispose of it, what doth it profit him?

#### A FEW HINTS FOR THE PLANTER.

We cannot in this short paper go into the details of apple orcharding, but simply throw out a few brief hints on the subject in a general way.

#### LOCATION.

In locating a commercial apple orchard, the first thing of importance is the facility or means of transportation for marketing the crop; soil and elevation are secondary consideration's to this one.

#### SITE.

The best orchard site is a moderately sloping hillside, north to northeast exposure if possible, so as to retard the blossoming period.

Avoid valleys, as cold air always settles to the lower ground; hence,

the more danger of late spring frosts there than on the higher elevations. And, as previously stated, good air drainage for the prevention of frost is of prime importance.

### PREPARATION OF THE GROUND.

Having located the orchard and chosen the site, proceed to prepare the ground by double plowing, using two large turning plows, one following the other in the same furrow; or a subsoil plow will be better to follow the turning plow. A good plan is to back-furrow the land so as to have the dead furrow come where the rows of trees are to be planted. After the first trees are planted, back-furrow the land so as to fill up the trench, leaving a dead furrow between the rows of trees. This method gives a deeper tilth under the trees, and affords surface drainage so as to carry off surplus water during heavy rainfalls.

### PLANTING.

Plant one year old trees; they are better than at any other age. Fall planting in the South is preferable; the ends of the roots that have been cut will callous over, and the trees will become well established and ready to start new growth when the early spring cultivation begins. Prune the roots quite severely; they will throw out new roots from the ends that have been cut, and they will develop a better root system and make a more rapid growth than if the roots are left intact. Set the trees two or three inches deeper than they stood in the nursery.

After planting, cut the top back to fifteen inches from the ground, so as to form a low head. After the buds have started into growth, rub off all but three or four; these are allowed to grow the first season without pruning; afterwards the limbs are to be cut back in such manner as to form the future head of the tree.

### CULTIVATION.

The cultivating of the ground in an orchard should be done as thoroughly as for a crop of corn. Frequent stirring of the soil to keep it well pulverized, from the time of planting to the first of August, is a necessity. Then a cover crop may be sown, such as cow peas, one bushel to the acre, or crimson clover, which is perhaps the best for the region under consideration. If these crops are turned under year after year, it will keep up the supply of humus which is so essential for the maintenance of a vigorous growth of the orchard.

While the trees are young, any crop that requires thorough cultivation and that will not interfere with the sowing of a cover crop may be grown between the rows of trees. After the trees have attained a size sufficient for bearing a crop of fruit, cultivation may cease for a while, and the ground be sown to clover or some other crop that does not require cultivation. This will check the growth of

the trees and cause them to form fruit buds and thus bring the trees into bearing at once; but, whenever the fruit fails to grow to its normal size or the trees show signs of lack of nourishment, the ground must again be broken up by using a cutaway or disc harrow, giving the ground good shallow cultivation. If necessary to keep up the vigor of the orchard, fertilizers should be used, such as barn-yard manure, wood ashes or commercial fertilizers.

### SELECTION OF VARIETIES.

The selection of varieties adapted to locality is one of the most serious problems that confronts the commercial orchardist. A mistake in this direction often results in great loss of time and money. David Crockett's motto, in this case, is a good one to follow "Be sure you're right, then go ahead."

As far as possible, avoid planting any variety that has not been tried and not found wanting. It does not pay to experiment along this line, except in a small way.

If data is lacking, select such varieties as are comparable with other localities of similar soil and climatic conditions.

Already you have quite a list of varieties that have been tested and shown to be profitable, as demonstrated by the exhibits made at your Horticultural Society meetings, your State and local fairs, etc. From such varieties as these select a few of the best. No commercial orchard should contain more than four or five varieties, and they should be grown in sufficient quantity to ship in carload lots. If there should not be enough to ship in this way from one orchard, unite with a neighbor or neighbors. In union there is profit. Join hands and pull together.

Among the varieties on your recommended list that have been found to be adapted to localities, first having been tested, and that deserve special mention for commercial purposes and will compete with the leading varieties of other apple growing regions, I would mention: Grimes, Rome Beauty, Gano, Kinard, Winesap and Pom-pome. There are a number of other varieties that will perhaps be found to be just as good as those mentioned. For instance, Col. John P. Fort, of Athens, is growing a seemingly promising variety. It was awarded a prize at the Spokane Fruit Show last December. On February 13th last I had the pleasure of receiving specimens of this variety from which a description and a painting have been made for placing it on file in the records of the U. S. Department of Agriculture. And while the apple is not of high flavor, its attractive appearance and excellent keeping qualities recommend it for a commercial variety of probable importance. Doubtless there are many other valuable seedlings in Northern Georgia that have not yet been brought to notice that will in time be placed in your catalogue of fruits.

## PROFIT IN SUMMER VARIETIES.

Wherever transportation facilities are favorable for shipping to northern markets, the growing of summer varieties can be made profitable.

If such varieties as Yellow Transparent, Live! and Raspberry, Williams and other fancy kinds are successfully grown and carefully graded, and each specimen wrapped in paper and carefully packed in bushel boxes or half bushel boxes, or the same even as peaches are packed, and each package carefully labeled, these fancy packages of fruit, when shipped to Philadelphia, New York and Boston markets, will arrive there far in advance of the northern grown fruit, and will command highest prices. I know of no branch of fruit growing that will pay better returns than this, if the business is properly handled.

No business will pay that is not intelligently and carefully managed according to modern methods, so as to meet the sharp competition that prevails everywhere.

The fruit industry of late years has been rapidly drifting westward, until at last it has reached the Pacific coast country, where in some localities it has surpassed all former records of productiveness and profits realized from small acreages. The Hood River Valley has become famous the world over for its wonderful production of fine market fruits. Raw land that could be bought there fifteen years ago for \$10.00 an acre, is now worth from \$300.00 to \$400.00. Bearing orchards bring from \$500.00 to \$1,500.00 an acre. Some of the best of these orchards pay 20 per cent. on a valuation of \$2,000.00 an acre. From 300 to 1,500 bushels of fruit are grown per acre, according to the age of the trees.

There are other localities in the northwest where similar results are obtained. Prof. J. L. Dumas, of Dayton, Washington, has an orchard of 100 acres of trees from nine to twelve years old from which he sold 35,000 boxes of apples last year, for which he received \$50,000.00.

A. D. Helms, who owns an 80-acre apple orchard in the foothills of Medford, Oregon, sold his crop of Yellow Newtons last year for \$2,000.00 an acre. He has been offered \$5,000.00 an acre for his orchard.

Last season Hood River apples sold for \$3.00 a box, and some lots brought as high as \$2.00 a box, and some even higher for small lots. It may be safely said that Hood River apples are more widely known today than the apples from any other section of the country.

Now, why is it that this new apple region, that but a few years ago was unknown, has gained such a world-wide reputation for its marvelous productiveness?

It is due no doubt more to organization, advertising and intensive culture than to natural advantages. Ten to twenty acres is the average size of the orchards. The result is the most intensive culture that can be given. Great attention is given to spraying the trees. The principal fight is against the Codling moth, of which there are several broods during the season. The apples are thinned on the trees just as you Georgians thin your peaches. This makes larger and more perfect fruit, and also conserves the vitality of the trees so that it is more likely to bear the following year.

The fruit is carefully picked, graded and packed in bushel boxes. And, by the way, I feel sure the box is to be the apple package of the future.

This box is lined with white paper, and a layer of white paper is placed between each tier or layer of apples. Frequently the apples are also wrapped in 8x10 white, soft paper. Under the rules of the union, no man is allowed to pack the fruit he grows. Packing is done by experts furnished by the Association, at a cost of five cents per box. On each box is a fancy lithograph on one end, and on the other end of the box is the name of the variety, also the names of the packer and grower, and the number of apples in the box.

Boxes cost from 7 to 14 cents in the flat. None but perfect apples are packed. The Hood River apples are so well known that buyers come to Hood River from all parts of the country, and even from foreign countries. Sometimes the crop is contracted for while the trees are still in bloom, as the fact of the worth of the Hood River apple has been so well established by its size, appearance, and the uniformity of the package.

Now, there is no good reason why apple growing in Northern Georgia cannot be made just as successful and as profitable as in the Hood River Valley or any other section of the northwest. If the same system of intensive culture, the careful uniformity of the pack, and the organized methods of shipping be maintained in Northern Georgia, the same results must inevitably follow. In Northern Georgia the price of land to begin with is much lower, and the large market centers are nearer by from 2,000 to 3,000 miles, thus enabling you to save much on freight rates.

Just as the Georgia peach grower has done, the Georgia apple grower can create a demand for high-grade apples. You have gained a wide reputation for your peaches, and the returns this year have exceeded your most sanguine expectations. The Georgia peach is known the country over for its high quality. You can grow the apple on the higher elevations of the State with the same degree of success. This means a larger population for Northern Georgia, more revenue to the State and its people, thousands of happy homes where now much good land is awaiting the magic touch of the plow and the hoe.

Foreign markets are open to American fruit growers. Buyers from England and elsewhere annually flock to our shores to secure the cream of the crop if possible.

With the possibilities you have at hand, and the whole world for a market, I say by all means grow apples in Northern Georgia

Col. WADE: I would like to say, in regard to Col. Brackett's advice that land for an apple orchard should be selected to slope to the north or northeast, that I have always been advised not to put in anything that did not slope to the south.

Col. BRACKETT: My reason for advising the selection of a northern location is, that the tree does not start to blossom as early in the spring, and the result is the fruit will escape the late spring frosts. But I do not think this would apply to the Albemarle Pippin.

Col. WADE: Then you would make an exception of the Albemarle Pippin?

Col. BRACKETT: Yes, sir; it is exactly the reverse so far as that apple is concerned.

Col. HUNT: Don't you think sowing the cow peas in fruit orchards induces the little worm called the "nematode," that makes the knots on the roots of fruit trees?

Col. BRACKETT: No, sir; I don't know that it has ever been attributed to that. I know that clover and peas add to the value of the land very much, by adding to its fertility.

Col. HUNT: I would like to say, that the Albemarle Pippin, according to a New York publication, is the same as the New Town Pippin of Westchester County, where

it has been raised for 200 years, and if you are going to plant it to sell my advice to you is, "Don't," for it is a shy bearer, and nothing is profitable that doesn't bear a big crop. The New Town Pippin is the best apple that I ever ate, but it is not a profitable apple. It is the best there is to eat, but it is not a good bearer.

Col. WADE: It makes more money than any other apple. I have a friend who sells as high as \$20,000.00 worth a year. This apple was taken over to London a number of years ago, but he could not sell it very well. He finally sent a barrel of them to the Queen, and she thought it such a nice apple that it was called for a long time the "Queen's Apple." I will say this, that if you take this apple and put it beside the Albemarle Pippin, you could not tell them apart. In fact, I believe it is better than the Albemarle Pippin. I have 2,500 of them growing, and I have much faith in it.

The PRESIDENT: I now introduce to you Prof. McHatton, of the Georgia State College of Agriculture, who will read you a paper on "Starting an Orchard."

## STARTING AN ORCHARD.

By Prof. T. H. McHatton, State College of Agriculture, Athens, Ga.

A paper on as trite a subject as this is of value in proportion to the amount of discussion that it brings forth. There are a few underlying factors in the commencing of an orchard which in a great measure determine the success or failure of the enterprise. Considering these factors in the order of sequence, we should begin with location.

### LOCATION.

What are the things to be considered in determining upon the location of a commercial orchard? The market, its accessibility and the type, is probably the most paramount. Whether the fruit is to

be shipped or sold in a local or, as it is sometimes designated, a personal market, determines in a great measure the location of the orchard. If the open market is to be used, the railroad and steamship transportation must be first looked to. Wherever possible, it is desirable to have two competing lines. That is, either two railroads or a railroad and water transportation under different management. The distance from the railroad is also due considerable attention; for example, apples will stand a far greater haul than peaches or plums, whereas nuts, such as the pecan and the walnut, may be hauled for greater distances than the apple. Besides transportation facilities and the market, the climate must also be considered. It is needless to say that in some sections climate is such that peaches cannot be grown to advantage, or, taking an extreme case but good example, it would be very foolish to plant citrus trees as a commercial possibility north of the Florida line. There are, however, a few bearing citrus fruits in the State of Georgia, but as a commercial success they are practically negligible.

#### SITE AND EXPOSURE.

After the location of the orchard is decided upon, we must next take up the consideration of site. This point is worthy of the greatest attention, as more of the orchard failures are probably due to poor site than any other one factor. It is strange that such a decided influence can be thrown around trees through the position, slope, etc., of the land upon which they are planted. One of the greatest influences of the site is probably that of air movement. It is hardly necessary to go into a discussion of this important point, as all of the members present undoubtedly thoroughly understand how cold air settles and the warm air ascends. Thus, where an orchard is in a sink or bottom, a blanket of cold air forms about it, especially during the frosty nights of late spring, and the tender blossoms are injured; whereas, if the air were in continued motion, the cold blanket would be carried on and the blossoms saved. A difference in elevation of two feet will oftentimes show a difference in temperature enough to spell "crop" or "no crop." Suffice it to say that no orchard should be planted in a hollow or pocket.

A trip through the mountains of Northern Georgia will show numerous plantings of trees surrounded on all sides by mountains, and with practically no way for the air to be carried off. It is not necessary, however, to plant on a steep hillside. A slope of six or eight feet in a hundred is considered sufficient to secure thorough drainage of the air.

The influence of slope is also worthy of considerable consideration. Someone told me, just the other day, that apples should never be planted on an eastern, southeastern or southern slope, and my opinion

was asked on the subject. Personally, I see no reason why the southern or above mentioned exposures of our mountain side should not be used for apples. In fact, it strikes me that it would be preferable to use these slopes for this type of fruit, and to save the northern and western slopes for peaches. A warm slope, that is, one toward the south or east, is conducive to early maturity and blooming, and therefore the trees are more in danger of late spring frosts than on the northern or western slopes. There is sometimes as much as a week's difference in the blooming of trees on hills with pronounced northern or southern slopes. The apple, on the other hand, stands less chance of being injured by frosts when planted on the warmer slopes. It is probably best to confine the peach plantings, when possible, to the colder slopes and put the apples, if anything must be planted on the other slopes, on the warmer hillsides. This of course is applicable only to the south, and would be reversed under northern conditions. If a planting is made on hills surrounding a body of water, the slope toward the water should be used. This, however, is not of great consideration in Georgia, as we have few, if any, bodies of water in the inland of sufficient size to modify or ameliorate temperature.

#### SOIL.

What kind of soil should I use for my orchard? This question is sufficient for a book, and so we will only be able to take a hurried glance at the subject. Pears and apples, or the pome fruits, do better on the heavier soils than do the drupes. It seems, however, that the red clay of Georgia produces a most excellent peach, and it has been said that the South Georgia sandy lands were not adapted to peach culture. This remark, however, must be taken with a grain of salt. It is almost a safe assertion to say that practically all of the land in Georgia will produce good peaches unless it is the sands of the seacoast. It is another proposition, however, when we come to the apples. From observation it would appear that the soil of Northern Georgia is best adapted to this fruit. It is a safe plan in deciding upon what soil to use to remember that the pomes prefer the heavier type, and the drupes, as a rule, do best upon the lighter loams and heavier sands. This subject will, however, be considered no further, as there was a paper presented last year before the Society devoted entirely to this question.

#### VARIETIES.

It is with some temerity that I enter upon the discussion of "what varieties to plant." This is probably the most knotty problem in horticulture, and to recommend any one variety above another is usually a very foolish thing to do unless all circumstances concerning the orchard are thoroughly understood. It is likely that the Horticultural Department of the United States gets the question, "What

variety shall I plant?" more than anything else; and it is also likely that wherever possible the answer very seldom mentions or recommends any particular one. So many things underlie the choice of the variety that it is almost impossible to do more than give a few rules, and leave the choice to the individual who is to plant the orchard. If the market sought is a personal one, the variety planted should be of the quality type; whereas, if the grower is going on the open market, he should use the shippers, such as the Elberta for peaches, and the Ben Davis for the apple, both of which are well known upon the markets of this country and both of which are considered, by those who know, extremely poor eating fruits. Secondly, the grower should plant the type of fruit that he likes. If you wish to grow a red apple, discard the yellow varieties; if you wish a free stone peach, discard the cling. For instance, the man who likes Buff Cochin chickens is apt to have poor success raising Bantams. As the third consideration, it is probably advisable to plant the variety that seems to do best in the locality where your orchard is to be situated. The best rule given for the choice of varieties is to consult with the growers in year neighborhood and find out what they are succeeding with.

It is seldom that the playing of checkers and the shooting of marbles around the country store is recommended, but if I were going to plant an orchard it is likely that when it came time to choose the varieties I would spend considerable time over the checker boards, moving Coca-Cola bottle tops, playing marbles and whittling sticks. At least, I would spend my time this way until I had had a talk with most of the growers of the neighborhood.

Another point to be considered is how many varieties should be planted. It is probably best to curtail the number in the commercial orchard to some four or five, and in some instances it is well to have only two or three. Plant enough of one kind to make an impression on the market; to be able to ship in carload lots, and get that variety out of the way before the next comes on. Do not have so many trees of one kind that it is impossible to get the crop harvested before the next variety comes upon the market. Also, plant a succession of varieties but have one or two afford the main crop.

Another question that comes to mind at this stage is, "Where shall I get the stock?" This may be answered tersely, "Buy it from the nearest reliable nurseryman." The reasons for such an answer are obvious.

#### LAYING OUT THE ORCHARD.

From the looks of many plantings throughout the state, one would be led to the conclusion that this point was sadly neglected. It is just as easy to have straight rows and a well laid out orchard as it is to have the trees crooked and out of line. We grant it is true that more fruit can be grown in a crooked row, but straight rows are so

much better to look upon, so much easier to handle and to cultivate. There are numerous methods of laying out an orchard; some of these being very simple, others quite complicated. In sections where the soil is light and easily worked, a plow may be used to advantage. A base line should be laid off, and enough stakes obtained to mark the ends of the rows of trees; then a plow, run by a man who can lay off a straight furrow, is all that is necessary. The furrow should be run one way and checked, and at the check the trees should be planted. In very heavy clay on rocky hillsides it is a hard job to lay off an orchard in this manner. It is probably best under those conditions to use a line and to dig holes. One of the simple methods of using lines is to get one long enough to reach across the desired area, tie a string or rag at each point where a tree is to be planted, and plant the trees while the line is in place. Another method is to take a line the length of the distance between the trees, lay off one base line with the distance between the trees marked on it; let a man hold one end of the line upon a stake on the base line, while another makes an arc with the other end of the line. Then A goes to another point on the base line while B makes another arc with his end of the line, and where the two arcs intersect a stake should be placed designating the position of the tree. This method gets the trees on the hexagonal plan. All these plans work well where the ground is comparatively level, but from personal experience it can be stated that it is a very hard thing to do to get trees in line on the side of a hill. It is undoubtedly best wherever plantings are made on the hillside to follow the contour of the land. The orchard here at the College was planted on the rectangular plan. However, this orchard is not a commercial proposition but an experimental plat, and was put out with regard to looks as well as utility. The number of trees to put on acre, or rather the distance apart, must be determined by the growth and type of tree. Peach trees planted  $16\frac{1}{2} \times 16\frac{1}{2}$  feet apart are considered by some too close; planting at that distance, there will be 169 trees upon the acre. Mr. Hale planted his first Ft. Valley peaches at  $13 \times 13$  feet, putting 289 trees upon the acre. Peach trees are now, however, being planted at from 18 to 20 feet apart. Greater distance of course must be left between apples. They should be from 25 to 35, and in some cases 40 feet apart. The variety used, the fertility of the land and all like factors must be taken into consideration when the distance is being decided upon.

#### PLANTING.

It is recommended that, before planting a tree, the whole area should be plowed and put into a very good system of cultivation. Where possible it is well to cultivate the ground to be used for the orchard in corn or some leguminous crop, the previous season. This should then be turned over before the trees are planted. As mentioned

above, in light soil planting may be done by the plow. In other words, where the furrow is laid out and the orchard checked, the loose soil can be thrown out with a spade and the tree planted in the hole thus made. This is quite often done with peach trees, and is undoubtedly a very inexpensive way to plant, and seemingly good success is attained through the use of this method. The rule, however, is that holes be dug to receive the trees. It costs at the rate of about four cents each to dig the holes for the trees in the College orchard. The land used was very stiff and heavy clay, and the holes dug were 2x2x2 feet, and in some cases deeper. In planting, the surface dirt was strewn in at the bottom of the holes and thoroughly mixed with a spade full of woods earth and, when obtainable, a shovel full of wood ashes. The dirt from the bottom of the holes was used to fill the top. In planting young trees it is absolutely necessary to work the soil well around the roots and to tamp the ground thoroughly when it is put in. The holes should also be filled a little above the level of the surrounding ground. Another system of planting is the Stringfellow method, in which a hole is made with a crow-bar, the tree put into this hole, and the pressure of the foot used to bring the dirt in contact with it.

Planting may be done in the South from the falling of the leaves to the beginning of spring. For many reasons, it is probably best to plant in the fall or during the winter. In northern climes it is necessary to plant before the ground freezes in the fall, or wait until after the thaw in the spring.

#### PRUNING.

There is quite a discussion as to the best method of pruning the roots of a tree at the time of setting it. The old system was to remove all of the injured, broken, twisted or otherwise objectionable roots, but to leave as large a root system as possible. Mr. Stringfellow, of Texas, however, recommends the pruning of the roots to a stub. This latter system seems to have succeeded very well on the lighter soils of Texas and in many sections of Georgia. Whether it is better than the old system, I am in no position to state authoritatively, but from results obtained at the Georgia Experiment Station it seems to have succeeded as well as the old system. With the peach, after the trees are planted they should be cut to a whip and eventually headed a foot or eighteen inches from the ground. With apples, pears and trees of like kind, which in many instances are two or three years old before being planted, it is only necessary to cut them back and remove surplus limbs. Trees two or three years old are usually headed before we get them. If possible, however, it seems preferable to plant apples that are only one year old, for then we can head them to suit our own ideas. The pruning at the time of setting is all that is necessary for the first year.

## CULTIVATION AND FERTILIZATION FOR THE FIRST SEASON.

The paramount question in the cultivation and fertilization of the orchard is whether it should be cropped or not. If a clean hoed crop like cotton or corn is used, there seems to be no reason why something should not be planted between the trees for the first year or so; still, if the ground is poor, it is probably best to give it clean cultivation until about the middle of July, and then put in a clover crop. Under no consideration should an orchard be cropped after it has begun to bear. Everything should be done for the production of the fruits, and cotton and corn do not increase fruit production. Under no consideration should a grain crop be grown among the trees. As for the fertilization the first year, one pound of fertilizer containing from 2 to 3 per cent. of nitrogen and high in phosphoric acid and potash is sufficient. If a crop is grown, it should also be well fertilized, but, as mentioned above, clean cultivation with a cover crop is probably the best method of caring for the trees. If apples or pears are to be set out, and it is the desire of the owner to have a sod orchard, the grass grown among the trees should not be removed, but should be allowed to stay upon the ground after cutting. Whether sod or clean cultivation is the best for an orchard, is not the question to be considered at this time.

At this point Col. Fort, Chairman of the Auditing Committee, read the Treasurer's report, which he stated was found correct and supported by proper vouchers; said report being as follows:

Statement of L. A. Berckmans, Treasurer, Georgia State Horticultural Society, from August 1, 1908, to July 31, 1909.

### RECEIPTS.

To balance brought over from last year.....	\$185.02
" interest on deposit in Augusta Savings Bank.....	5.41
" annual dues from members .....	120.00
	<hr/>
	\$310.43

### EXPENDITURES.

1908.	
Aug, 3rd, 20 yds. ribbon, for badges.....	\$ 4.00
" 12th, Yonah Publishing Co., printing programs.....	3.00
" 13th, B. W. Barrow, for reporting meeting (reporting \$25.00; R. R. fare and hotel \$15.40).....	40.40
" 14th, L. A. Berckmans, Treasurer, expenses to Cornelia and return . . . . .	12.29

" 15th, L. A. Berckmans, envelopes and exchange on checks	5.51
" Augusta Chronicle, printing .....	6.00
" " Richards Stationery Co., cash book.....	.50
" 27th, J. B. Wight, Secretary, postage .....	2.00
Dec. 7th, Augusta Chronicle, printing.....	3.00

1909.

March 6th, Expressage on Proceedings Atlanta to Augusta.....	1.45
" 8th, 1 globe file .....	.25
" 9th, Express on Proceedings to J. B. Wight, Cairo....	1.05
" 19th, Dept. of Entomology, printing proceedings.....	50.00
July 15th, P. J. Berckmans, President, postage account.....	6.85
" " L. A. Berckmans, Treasurer, postage account.....	7.10
" " J. B. Wight Co., badges.....	2.50

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\$145.90

" 31st, balance on hand Aug. 1st, 1909..... 164.53

Approved and found correct, Aug 4th, 1909.

JOHN P. FORT,  
L. L. McCLESKEY,  
Committee.

On motion, the Treasurer's report was accepted as correct.

On motion the meeting adjourned until Thursday morning, August 5th, at 9 o'clock.

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#### THURSDAY, AUGUST 5th, 1909.

The President called the meeting to order at 9:00 o'clock a. m.

The PRESIDENT: The first paper on our programme this morning was one by Mr. Hunt, but as his remarks are intended mainly for the benefit of the ladies, who received a cordial invitation to be present and who responded last night by saying they would come in force this morning; but, as it seems they have not yet arrived,

I will therefore let Mr. Hunt's paper go over until we have more ladies in the audience. As Prof. McHatton has asked me to let him submit the report on fruits, I will now give him the floor.

Prof. McHATTON: Col. Brackett, Chairman of the Committee on Fruits, being absent this morning, has asked me to submit his report for him. I suppose on account of the weather and the season of the year, our exhibit of fruits and vegetables is very small.

The first exhibit that I would call attention to is that of Mrs. E. K. Lumpkin, who is President of the Garden Club of Athens. She has sent a plate of Lemon Figs and one of Brown Turkey. There is not much to be said on these; the Brown Turkey looks very much like a Celestial, only it is a little larger and almost a perpetual bearer, and is also a better canning fruit than the Celestial. The Lemon Fig is very good for eating out of hand.

Mrs. Lumpkin also sent a plate of Chinese Giant Bell Peppers. They are not quite up to the type, not being quite large enough, but I suppose on account of the lateness of the season they are not quite as good as they ought to be. She also sent two ears of white Evergreen Corn; it is not fully matured, but one ear is nearly 12 inches long. Also three kinds of tomatoes, one being the Ponderosa, which we are all familiar with; a great many people like it, but I think it is too large. Then the Crimson Cushion, which is in very good shape. In fact, all these specimens are good. This has the same trouble, however, as the Ponderosa, it is too large, only it is a smoother and prettier fruit. I want you to notice the shape, size and smoothness of the third tomato, the Tucker's Choice; it

has an excellent shape and very thick skin, and should make a most excellent tomato for trucking purposes on that account. The Ponderosa is entirely too large, but the Tucker's Choice should find a larger market and bring a better price.

Col. Fort has brought in two peaches and one apple. It is a little late for peaches; the Elbertas would have been very pretty, but they are a little decayed, possibly from the rains, and being late in the season, they show a very fine color. I always notice the color of the Elbertas; whenever we get them from the northern part of the State, we get a fine colored peach, especially when they come from around Cedartown.

There is nothing much to be said about these peaches. The Colonel says that he also has a quantity of seedlings that will be on in ten days. Then he has brought in some Transcendant crabs, which are very beautiful and which have a very nice color. They are excellent fruit for home use, mainly for jelly purposes.

Then we have an exhibit of three peaches back there, brought in by Mr. Lewis of the Entomological Department. They are Elbertas, picked a week ago, and are in very good condition today; they were sprayed three times with lime, sulphur and lead arsenate.

Mrs. Stewart, a member of the Garden Club of Athens, sent some nice figs without a name; she also sent us a vase of Cannas, in several varieties.

I want to make a remark about the apple that Col. Wade brought in. It was shown before the Society last summer; it was grown in North Georgia, and the same apple has been grown at Mr. Berckman's place. I think

the difference in size, shape, etc., is due to location. This apple is known by me as the "Poor House," but after looking the matter over and talking with Col. Wade, Mr. Berckmans and others, it seems that the original name of this apple was "Winter Queen," and it had a synonym in the section of the country from which it came called "Winter Gem," but the majority of the people call it "Winter Queen." It also has a synonym, I think, and is sometimes called the "Wade" apple. Exactly the name of this apple I am not in a position to say, but from priority, and from the use wherever possible of the name first applied to a fruit in its local section, irrespective of the name of the introducer, it seems that the prior claim of this apple would be "Winter Queen."

Our exhibit of fruits is quite small, and of course we all understand why: The crop this year was not very large, and the seasons have been poor for an exhibit, but I think altogether there are some points that can be learned by close observation of the exhibit, and it would be worth anybody's time to look over the fruit and examine it.

The PRESIDENT: I think in the nomenclature of the apple the proper name of this Poor House apple is "Winter Queen." It was really called "Poor House" afterwards. That is the actual name under which it is now known by all nurserymen.

Col. WADE: I wish to say a word about the nomenclature of that apple. Eight years ago that apple was an "unknown quantity," in this respect. It had been sent out and reported forty years ago, and is in the list of apples published at that time. But it was forgotten and

lost until a traveler happened to pass through our section of the country, from Sewanee, Tenn., to Augusta, Ga., from whom I bought a few scions and made about 100 trees, which were planted out. It bore a large greenish apple, which ripened about June or July. A few years after that I got the services of Mr. Berckmans; he took a few scions and propagated them in his nursery at Augusta. Some specimens of this apple were sent to the United Staates Pomological Society, and word was sent back that it would be called the "Poor House" apple, as it was a very poor apple to go on the market. I was afterwards told that it had been named the "Wade" apple in compliment to me, but as to that I know nothing. Later I found a gentleman who had the same apple and called it the "Winter Queen," and I have more apples under that name growing in my orchard than anybody else on earth. I think it very silly and foolish to call it the "Poor House" apple; I think it should be called the "Winter Queen." If you put it beside the Albemarle Pippin you can not tell the difference between the two. I think it originated from the New Town Pippin, that undoubtedly was taken from the East and carried South and West, and this apple came from it just as the Albemarle Pippin did. This apple is an annual bearer, and very prolific. I have had large limbs broken off my trees entirely from the weight of the fruit. I have simply had to go in my orchards and strip the trees, because it is too great a bearer for the size of the tree. We have known this apple now for ten years, and I think information about it ought to have wide circulation. I have 2,500 trees now growing in my orchard, and I do insist on having a first-class name for it. If you will notice, it

has a red cheek, and that is all the more reason why it should be called the "Winter Queen."

Mr. ROWLAND: Col. Wade has put me in a dilemma in regard to the name of that apple. When I saw him two or three years ago, he called it the "Poor House" apple, and I was so impressed with it that I made inquiry of two or three nurserymen, who explained to me that it was a very fine fruit and had gotten its name from a very fine tree that grew on the grounds of the Poor House in Sumter county. I looked it up, and found that grafts had been obtained from this tree, and were known as the "Poor House" apple. One of my kinspeople said that it was the best of all cooking apples, that nothing preserved as well, and so I bought, under that name, 20 or 25 trees from a well-known nurseryman, and this year I have gotten my first two or three apples from it. What am I to do now? Am I to call it the "Poor House," the "Winter Queen," the "Winter Gem," or what am I to call it? The Tennessee people know it as the "Poor House," and you can not get it by any other name.

The PRESIDENT: There is a fine apple that we discovered in North Georgia some years ago. It was a beautiful yellow apple, and was sent to us in the winter time by some one who came to Augusta. When we asked him what its name was, he said he got it from a fellow who called it the "Yellow Hogpen." I said "That is no name;" still, it is one of the finest winter apples they have in North Georgia. Now, I think "Poor House" is a very poor name, and that "Winter Queen" is much better. What is the pleasure of your Society on the sub-

ject of the disposal of the Report on Fruits, which has just been made by Prof. McHatton?

On motion, duly seconded, the report was accepted.

The PRESIDENT: I now have the pleasure of introducing to you Mr. H. E. Waernicke, Representative of the Land and Industrial Department of the Southern Railway Company, who will address you.

Mr. WAERNICKE:

Mr. Chairman, Ladies and Gentlemen: When I reached Athens yesterday, I was very much surprised to find that my name was on the programme. I had not expected to be called on to say anything, and consequently had made no special preparation. I want, however, to assure your worthy President and members of the Society of the very active sympathy of the Southern Railway in the work of the Georgia State Horticultural Society, and of similar organizations, that have for their purpose the further development of the agricultural and horticultural and industrial resources of the State of Georgia. I think that our sympathy is amply demonstrated by the fact that in this meeting there are three representatives of the Southern Railway, one of the Freight Traffic Department and two of the Land and Industrial Department, which latter department is more intimately connected with this work.

During the fifteen years that I have been identified with the Land and Industrial Department of the Southern Railway, we have watched very closely the excellent work that has been done in a quiet and unostentatious way by this Society, and the particularly excellent work that has been done personally by your honored President; and I want to say that we have been greatly helped in our work, in our efforts to further interest people in horticultural work, through the information and co-operation that we have received from the Society, and particularly from Dr. Berckmans.

It seems to me that the work before an organization of this kind in the State of Georgia is a most important one and the efforts put forth by the Society should receive the heartiest co-operation of all people interested and engaged in the growing of fruits and vegetables on a commercial scale, as well as those who have not yet taken it up. An organization of this character, with the very earnest, intelligent and well trained men who are connected with this active work, can certainly be of untold benefit in working out the problems, of which there are many, surrounding an industry of this character.

I always feel enlightened and greatly benefitted by hearing the excellent papers that are read at these meetings. It is a matter of regret to me that more of the citizens of Georgia are not here to get the benefit of the valuable suggestions and plans which I have heard outlined in the several papers already presented. The Southern Railway Company, through its Land and Industrial Department, and its other departments, is working in many ways in co-operation with the various factors engaged in this development work. During the past two or three years, we have adopted the method of operating special Farmers' Institute trains, over our lines, in practically every state that we traverse. We have done this work in the closest co-operation with the State Departments of Agriculture, the Agricultural Societies and with the Agricultural Colleges. These institutions furnish the lectures on various topics, corn growing, fruit raising, vegetable growing, forage crops, etc., and the Railroad Company furnishes and equips the train and sends its representatives along. By this means we have been able to reach a large number of farmers in isolated sections of the country, which it would have been very difficult and expensive for the state authorities to reach by the ordinary Farmers' Institute work. It has enabled the railway company to get in closer touch with the farmers, which has been the means of the State Departments of Agriculture doing likewise, getting in the hands of the farmers literature, talking with them in a personal way about the difficulties that are constantly coming to the front in their farming operations, and aiding them in various ways in producing larger crops, making their farms more productive, and their homes more comfortable.

We would like to see this Society grow to ten-fold its present proportions in membership. The work that it is doing and the force and intelligence that the officers and members have put into it, certainly deserve the heartiest co-operation and the maximum support of all interested in agricultural and horticultural pursuits in the State of Georgia. I think it might be a good idea for each member of the Society present to pledge himself, or make up his mind, that between now and the next meeting, which I understand is to be on the fourth Wednesday in January, 1910, that he will make an earnest effort to bring with him to the next meeting—I will not say as members, we will get them in that condition afterwards,—but bring to the next meeting, each member present, at least five persons, who can be interested in furthering the work of horticultural and agricultural development. I am sure that the majority of these people would be only too glad to join the Society when once they realized the intelligent effort that is being put forth and valuable suggestions that are emanating from these skilled and experienced men who have studied the problems connected with horticulture, and those who have never been here before would go home feeling that they had been materially

benefitted by their attendance upon these meetings. I merely offer this as a suggestion, because of our desire to see this work grow, and become more widely extended all over the State of Georgia. I thank you for your attention.

Col. WADE: I offer this resolution and move its adoption in order to settle the name of the apple, namely:

*Resolved*, That the winter apple known as the "Poor House," "Winter Queen," "Winter Gem," etc., be hereafter listed as "Winter Queen," with proper synonyms that have been added.

Mr. HUNT: I second the motion. Not long ago the New York State Horticultural Society sent me a bulletin on apples, and the synonyms were staggering. I do not know how many names the New Town Pippin has under that bulletin. For the benefit of Mr. Rowland I would say that there is no apple worthy of mention that does not go under a lot of synonyms; and the synonym in the apple is a title of nobility, as it were. It wouldn't have all those names if it were not prized by the people who grow it. Now, this Society, presided over by Mr. Berckmans, has the right to name that apple as they choose to name it, and I second the resolution offered by Mr. Wade, and hope it will prevail.

The PRESIDENT: The only difficulty in the way is that Mr. Regan, who is a specialist of the Division of Pomology in the Agricultural Department at Washington, and especially upon apples, has called it the "Poor House," and given that as its official name. He gives "Winter Queen" as a synonym. But I hope that the name "Winter Queen" will be adopted as more appropriate. Now, there is an apple called "Wade" that was

introduced many years ago, and that name has already been catalogued, so with all due respect to Mr. Wade, and very much to our regret, we can not hold it under that name. You hear the resolution, duly seconded, that the apple called "Poor House" be hereafter known as "Winter Queen," etc.

The motion was unanimously adopted.

The PRESIDENT: We were expecting a large number of ladies in the audience this morning, but as unfortunately there are only two or three, Mr. Hunt proposes to let his paper lie over a little while until we can have more ladies present. In the meantime, if Prof. DeLoach is ready with his paper, we would like to hear from him.

Prof. DELOACH: Yes, sir, I am ready; but my paper is just as important as that of Mr. Hunt. I am really more of a botanist than I am a horticulturist, and of course when this paper was assigned me I felt that I was partly in duty bound to write something on it.

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## THE EFFECTS OF CROSS POLLINATION IN HORTICULTURAL PLANTS.

By Prof. R. J. H. DeLoach, of the State College of Agriculture,  
Athens, Ga.

Thomas Andrew Knight (1759-1838), an English horticulturalist and physiological botanist, was the first to show the value of cross pollination of fruits. As early as 1806 he said: "New varieties of species of fruits will generally be better obtained by introducing the farina of the variety of fruit into the blossoms of another than by propagating any from a single kind." He holds the same place in relation to improvement by crossing that Van Mons holds with reference to selection. A. J. Downing, a writer of considerable note on fruits and fruit trees, said in 1836: "Assuming Professor Van Mons to be strictly correct, we

would suggest that a great saving of time and a considerable improvement, in quality and vigor, might be gained by calling in cross-pollination to the aid of the cultivator as soon as the fruit of the trees (say the second generation) begins to show symptoms of amelioration. By impregnating them with pollen of the finest varieties, we conceive that the next generation would produce excellent fruit, and at a saving of twenty or thirty years."

In 1844 Hovey, a plant breeder, said: "The results will be obtained in a shorter period by cross fertilization and, we believe, equally as favorable as by the method of successive generations alone."

Knight, Hovey, Allen and Downing succeeded well in establishing confidence among horticulturalists in the possibilities of cross pollination, and it came to be a general practice, but very little fundamental knowledge was added to the subject till biological students of modern times began to apply laboratory methods to plant breeding investigations, and investigators combined cytology with field experiments. It is rather interesting that the early hybridizers mixed pollen from different sources to pollinate with, contending that in this way the 'ovary' would be strengthened. Variation in fruits and other plants as we know it is comparatively a new subject, because new conditions and new environment, better methods of cultivation, and more liberal applications of fertilizers, as well as almost unlimited crossing, have rendered variation far more conspicuous. The number of professional and commercial plant breeders has grown to such enormous proportions within the last decade, especially since Mendel's laws of heredity and work in hybridization have been rejuvenated, and as a consequence so many ideals set up that we naturally have a great many varieties from time to time of all the cultivated or artificial plants. Each new creation seems to have inspired breeders to make greater efforts to create and name still other new fruits, etc., and this eagerness to get something new has caused us to neglect to give an account of our methods of breeding and the history of the new varieties produced.

#### TECHNIQUE OF CROSSING.

This phase of the subject needs very little discussion in the present paper. Most horticultural plants have perfect flowers. To cross pollinate, the flowers must be emasculated before any of their own pollen grains are ripe, in order to be sure of not having self-fertilization. Authorities differ as to when pollination should take place after emasculation. Some say that pollination should be at the time of emasculation, while others say that a day or two later is better. Price found a considerable advantage in pollinating at the time of emasculation. To emasculate, one must carefully remove the partially unfolded corolla, down near the base of the calyx, and trim the stamens with a small pair of scissors, it being absolutely necessary to get every anther

from the flower in order to avoid the possibility of self-pollination above referred to. If pollinated at the time of emasculation, the pollen should now be brought from the flower to be crossed and applied to the pistil or the newly emasculated flower. There are as many methods of applying the pollen as there are plant breeders, but the usual way is to apply the collected pollen with the camel's hair brush. I have obtained fine results by dipping the stigma into the pollen that has been collected on soft paper. In case that the pollen is to be applied one or two days later than the emasculation, the stigma should be securely covered with a small paper or linen bag, in order to keep insects away. Then, when the pollen has been applied, cover again as before, for a day or two. Then remove bags and the work is done. The pollen grains will be dissolved by the pistil and the male nuclei follow the channel of the style down to the ovary, and fertilize the ovules. Until this is done the young fruit will not set. If the pollen has been applied in sufficient quantities, and the cross not too radical, most or quite all the seeds will develop, in which case the fruit will be better, and the breeder will have a much better chance to get seedlings. Apparently, a few fruits have been developed that need no fertilization of flowers,—for instance, the seedless orange. I have not studied the morphology of this fruit, and cannot discuss it. Generally, the fruit depends upon the development of the seed, and the development of the seed depends upon the fertilization of the ovary with pollen, and this depends in turn on the successful fusion of the nuclei of the ovule with the pollen grains.

### EFFECTS OF CROSSING.

One can say without fear of successful contradiction that crossing when properly applied will be found a means of combining desirable qualities in two or more fruits sufficiently related to admit of crossing at all. If the Russett apple is to a great extent disease resistant, and the Baldwin a large beautiful red apple, but somewhat susceptible to certain diseases, we may combine these two qualities by crossing. This of course will entail upon the breeder a great deal of detail, for the dominant and recessive characters must be studied and the strength and breadth of the alomorphic pairs known. For instance, if *red* and the *lack of red or green* constitute one of the alomorphic pairs in a cross between the Baldwin and the Russett apples, the breeder must take careful notes as to which one of these pairs dominates in the first generation of crosses, and he must further calculate what per cent. of the total area of the apples in the second generation or  $F_2$  generation will be red, if he would secure the desired results in the minimum time.

Another good effect in crossing is the infusion of new life into the offsprings. They seem to be more vigorous and hardy. An illustration of this is found in the cross between the Newton apple and the several other varieties. In every case the offspring was far more vigorous and a more

sulable fruit. It might be claimed that all the qualities were not improved in any specific case, but, on the other hand, the size and appearance was greatly improved without exception. Where the apples were crossed, they showed increase in weight and in the number of seeds developed.

The Spitzbergen apple is almost self-sterile, being able to set only about 3 per cent. of its own fruit. When crossed with Ottley, Baldwin and other varieties it was much improved. The few self-fertilized Spitzberger were small, ill-shapen, and otherwise objectionable. To what extent then are self-sterile apples improved by cross fertilization? In each of the above cases, they were greatly improved, and the conclusion among horticulturists is that this rule is almost if not quite universal, that where apples are found to be self-sterile, the few individual fruits that may prove self-fertile are not as good and strong as those on the same trees that are obtained by cross pollination.

Is self-sterility brought about by cross fertilization? There is some reason to believe that, where plants are continually crossed for effect, they eventually come to depend for fertilization on foreign pollen. Many cases of self-sterile horticultural plants have been brought about by crossing foreign on native fruits. However, in this way we have been able to produce much of our best fruit. As we come from the distant past, when most of our varieties of fruit were foreign, to the present when most of them are native or American-produced and American-named, we cannot fail to notice the activity of growers and the eagerness of speculators to adopt the promising new fruits. The foreign element has continued to pour into most of our horticultural plants. Among the last of these is the "New Hybrid Fruits" at the South Dakota Experiment Station published in Bulletin 108, May, 1908. Our native wild fruits seem to be susceptible of considerable development when crossed on good foreign fruits. The sand cherry on the Chinese apricot is a good illustration of this. Another is our native plum on the Chinese apricot. By means of these crosses, foreign fruits are easily adapted to our soil and environment, as well as climatic conditions, and at the same time our native fruits are being greatly improved.

#### LIMITS OF CROSSING.

There are bad as well as good effects from cross pollination, and my paper would not be complete without devoting some space to this phase of the subject. Bailey has said: "Crossing is useful as a means of originating new forms adapted to man's special uses, and also as a means of revitalizing the offspring by providing new combinations of characters which may better enable the individual to compete in the struggle for existence; but there are limits beyond which crossing is useful neither to the species nor to man." What are these limitations? To what extent may crossing be made to prove profitable, and when does it work

injury to the plant? If the cross ceases to be useful to the plant shall we consider it wise to continue crossing for benefits to man? Artificial or cultivated plants have very few of the natural factors of limitation to work under. They have no struggle for existence. Man does their struggling. The weed is hardier, and would get the better of the cultivated plant, but man steps in and destroys the weed. In two ways man aids cultivated plants: By selection and cultivation, and by destroying their enemies. Therefore the great consideration is improvement. Making something better, along definite lines and for specific purposes.

When selection is not sufficient to produce the required effect in the improvement of plants, crossing varieties is resorted to. When the end in view has been attained without too much sacrifice, the breeder is fortunate. Sometimes self-sterility is so pronounced that the desired fruit will have to be abandoned, the latter action dependent on accessibility to or our possibility of growing the desired pollen with which to fertilize the sterile varieties.

This leads to a consideration of the causes of self-sterility in orchards. One authority says that the cause of self-sterility is "that the pollen of a variety is unable to fertilize the pistils of that same variety." But this is only half the truth. The other part of the question might with propriety be asked: Why will the pollen not fertilize the pistils of the same variety? Cannon has come nearer the truth in his discussion,—the Cytological Aspects of Breeding. In order for the pollen to fertilize the ovules without a radical disturbance, there must be a common number of *chromosomes* and consequently a like reduction of *chromosomes* in the sperm and ovum. The spermatocyte must be the morphological equivalent of the oocyte. There is then a possibility that part of the offsprings of certain crosses,—I might say radical crosses,—are part normal and part abnormal. The normal adhere to the original method of cell division, and the latter do not. In the normal development, the sperm and ovum had an equal number of chromosomes, in which case the spindle would be exactly like that in the parent types. In the abnormal development we may have direct nuclear multiplication, or amitosis, and consequently a general biological or morphological difference. The last or abnormal difference, Cannon says, may be the cause of self-sterility, and the former or normal development the cause for fertility or self-fertility. In order to successfully answer the question, there must be a combined study of cytology and field experiments. The whole matter is a problem of morphology, and without making cytology the basis of an investigation of this problem, one cannot hope to unravel the fundamental truth.

#### SUGGESTIONS.

It is suggested that, inasmuch as there are so many institutions in the country that exist solely for research work and experimental investigations, horticulturists follow well-tried methods and refer new problems

to such institutions. Practical crossing and not theoretical breeding is the only safe rule for the ordinary horticulturist. The work in cross pollination should be principally with self-sterile varieties, and the pollen used should be from thoroughly tested varieties. Or, if foreign pollen is known to work well with self-fertile varieties, no risk will be run by such practice.

References:

- Bailey, Survival of the Unlike.
- Cannon, Cytological Aspects of Breeding.
- Bulletin No. 132, Maine Station.
- Bulletin No. 104, Oregon Station.
- Bulletin No. 181, Cornell Station.
- Wilson, The Cell.
- Bulletin No. 108, South Dakota Station.

Mr. HUNT: You say in cross-fertilization you use the camel's hair brush, or a spoon, or some instrument. What objection have you to picking the whole bloom which contains the pollen, taking it stigma and all, and dust that pollen by holding the stem of the bloom over the emasculated flower?

Prof. DELOACH: The principal objection I would have to that, is that that is not, strictly speaking, a scientific method; because when you are experimenting you have to find out how many flowers are satisfactory, and suppose you had to pull a dozen or two flowers from one tree? You would destroy that many, and therefore you would reduce your study, you might say, to guess work. You might possibly pull the best fruits off the tree in order to get this pollen.

Mr. HUNT: Let me illustrate it this way: For instance, the Department of Agriculture has taken up the breeding of various fruits, and they wrote me that they wanted me to hybridize some citranges as they bloom, advising me to cut the buds off half way down before

the bloom opens, take off all the pollen stems and wait a day, then dust the pollen on that plant. They wanted me to cross the citranges with others, and also with a lemon that Mr. Berckmans brought here in 1870. What difference does it make to me how many blooms I take off that tree? I am losing nothing by taking the whole bloom and dusting it on the stigma of the citrange, which I wish to hybridize. When I first emasculate the flower I dust the pollen on it, and I hope the pollen grains will last until the next day. Sometimes I lay the pollen right on the stigma, just take the bloom full of pollen, lay it on the stigma of the citrange, put a paper bag over the whole and leave it there. What objection is there to that?

Prof. DELOACH: The only difference between you and me is that I never regard the other tree as of any less importance, that is, the tree where I get the male element, than I do the tree where I am brooding the fruit. I want to know how valuable that is in the matter of producing fruit, I want to know how much fruit will set, I want to know the capacity or per cent. of self-fertility in the male. Strictly speaking, scientific practice would demand that you do not pull a flower. I pull the flowers in my study of cotton, just as you say, because I am not particular in counting the flowers, but whenever I am particular I get the pollen on a soft paper and I dip the stigma of the other in it. But there is no objection in the method you describe, none whatever, but I believe you would lose some valuable information if you were doing strictly scientific work.

Mr. HUNT: Let us go back to the citrange I have in mind. I want to cross it with the kumquat, for in-

stance: I have a kumquat with 400 or 500 blooms. Suppose I take a bloom off this kumquat, what does it matter? I am not trying to do anything with the kumquat.

Prof. DELOACH: In that case you do not apply scientific methods.

Mr. HUNT: I was not caring for the male plant if I could produce a fine hybrid.

Prof. DELOACH: But, as I said a little while ago, we are eager to produce new fruits, and the man who is hunting new fruits has to go back and find what is the effect on the male and on the female plants.

Mr. HUNT: I want to ask also, whether it is not a fact that science indicates that plants are going through that change that animal life went through when it was a hermaphrodite, male and female. Isn't it a fact that the best dates in the world are absolutely dependent upon the winds of the Desert of Sahara taking the pollen of one tree and dusting it on a bare tree? The same way with the best figs. When you come to the Smyrna type of fig, you could not dust that without ruining the type, so when the pollen was ripe I just cut open the fig and put the pollen in with a pen knife and toothpick and you could not have done it in any other way, could you?

Prof. DELOACH: No, sir, I hardly think so; but I am not expert on that kind of work.

Mr. HUNT: Mr. Munson says that even the *rotundifolia* do not have pollen enough to perfect their own fruits, and it looks as if we will have to pollinate the best of the

rotundifolia family. In fact, it looks to me as if we are going to have to develop horticulture on lines very much like animal breeding is done. What is your opinion about that?

Prof. DeLOACH: Yes, I believe that the continuation of cross-pollination leads to that end. I believe that the survival of the fittest in self-fertilization would hold up forever.

Mr. HUNT: Yes, sir; the citranges are becoming almost seedless now. Now and then you will find one with only a single seed, and it will certainly not be raised from the seed much longer.

The PRESIDENT: The term that Prof. DeLoach used, "survival of the fittest," is very applicable in the production of fruits. We have found that principle to be very prominent when we look back to all the old experimentalists, beginning with Mr. Knight of the Horticultural Society of London, seventy-five years ago. The theory was to take the very largest fruit as a standard, and hybridize it with the pollen of smaller but better varieties; but the results never amounted to anything at all. Another theory of Prof. Van Mons was to use, as Prof. DeLoach says, the survival of the fittest. He took what he called the natural increase in quality; for instance, he went on as far as even the twelfth or thirteenth generation. As its first beginning, he took a wilding partially improved; he then took the seed from the best fruit of that, planted it, waited a few years very patiently, planted again. The second generation was a little more precocious; and so on until he finally got a fully improved fruit. But he had calculated wrong in one thing: He

had not calculated on atavism or ultimate reversion to the natural type. After the fruit had arrived at a certain amount of perfection, where it could not become any more perfect, it was either seedless or it reverted immediately back to the first beginning, and there the whole of his theory fell to the ground. But from the result of his experiments we have today the very best pears in cultivation, originated from the natural selection of seeds, or the survival of the fittest. As to what he found in the fourteenth generation, he found out it was either that or the extinction of the species; that the seeds were faulty or absent. We find it in the citranges. Those that we have fruited have a fine looking appearance, beautiful in shape, but are seedless, tasteless, and in fact unfit for anything. The experiments of our friend Dr. Weber have resulted in producing an orange, or rather a fruit that was between the trifoliolate and the orange, and has all the hardiness of the hardy lemon; but he is only at the beginning of his experiments. After awhile, after three or four more crosses, he will then reach perhaps what he expects, and then possibly we will have an orange tree bearing good fruit in this section. I am very much pleased with your paper, Prof. DeLoach, and although you state that you are not a horticulturist, I think you have given us much valuable information on that line.

Prof. DeLOACH: I want to ask one question, Dr. Berckmans. In the first year hybrids of that citrus trifoliolate on to the Florida orange, wouldn't it be possible to stop that cross right there and make a continuation of that fruit on budding or grafting, because in the second generation, according to Mendel's law, we have what is called a general breaking up of types. In the first gen-

eration, if we get anything that we want, we must get the dominant characters. If in those dominant characters we get what we want, wouldn't it be best to graft them or reproduce them from buds?

The PRESIDENT: .Possibly so, and I hope that these experiments will be continued. You have benefitted the profession in bringing about a better quality of cotton and better quality of grains, and your experiments have been along those lines more than of fruit. But we rely upon such men as you to bring about improvements along all those lines.

Mr. HUNT: This paper of mine isn't a paper at all, but I have treated of citranges, not as economic plants, but as hardy ornamentals, and we will reach them after a while. But I would like to say a few words that I did not put in my paper, regarding Mendel's law, and that is that we do not care how fertile a fruit becomes, it isn't like cotton, because we can bud it on a trifoliate stock as all the citranges are now budded, and they are not expected to grow on their own roots, but put them on the roots of Mr. Berckmans' importation of trifoliate. I will now proceed with my paper.

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## HARDY ORNAMENTAL PLANTS IN MIDDLE GEORGIA.

By B. W. Hunt, of Eatonton, Ga.

Plants that are ornamental to me may not carry a similar message to others. I shall speak for myself alone, giving my own point of view.

I include as hardy plants those that live planted in the open ground, and that flourish without winter protection. I can not name conditions

of shade, sunshine or shadow part of the day, that individual plants prefer, without burdening this paper with too great a length.

### THE PALM.

The palm, that may have fed, sheltered and clothed our ancestors, takes on additional dignity and interest from its legendary and historical association with man. The bosom that has nourished the child becomes to the grown man the most beautiful attribute of woman. It is doubtless impossible for man to divorce the plant or object observed from its association with the human race. The palm tree still furnishes man with food, drink, clothing, shelter, paper, starch, sugar, oil, wax, and many other necessities and luxuries. It is still used in Christian religious rites, and itself is the emblem of victory. One can not avoid considering its usefulness, its historical and legendary associations, and all this affects our point of view. Still, I think the palm, judged wholly on its decorative merits, deserves to rank among the very first of our ornamental plants. While three different varieties of palms have lived out of doors for several years in my grounds, none have proven truly hardy. The latest developed, immature leaves are occasionally damaged by extreme cold in winter. *Chaemerops Excelsa* is surely the hardiest, next to the California Fan palm and the tree palmetto of our coast region. The dwarf palmetto is hardly, and grows wild a few miles south of Eatonton, but it forms no trunk. Its natural habitat includes the flatter, sandier soil from the gulf and the ocean, to the great divide made by the drop at the Piedmont Escarpment. The *Chaemerops* palms live out of doors in Europe where the thermometer registers colder than we endure. No young palms should be planted in the open ground. With age they appear to develop hardiness, and after a few years growth in pots they may with more safety be transferred to the ground. Willey Muller, of Naples, Italy, and Dr. Franceschi, of California, recommended a palm called *Jubaea Spectabilis* for its hardiness, but no eastern states nurserymen appear to catalogue it. This is a pinnate palm, possibly more ornamental than the others I have named, and if it proves hardy will be the most desirable of all our out of doors palms. Residents of the sandy coast region have the choice of many palms, hardy with them, that we may not plant out of doors. A visitor from Middle Georgia to Savannah, Charleston, and other coast cities, is disappointed by the absence of many ornamental palms that he believes would prove hardy near the ocean.

### YUCCAS.

Many of the tree growing varieties of yuccas have proven hardy in middle Georgia, and they make good substitutes for palms in landscape gardening. Indeed, one has to approach near enough to examine closely the plant before he may be sure whether he sees a palm or yucca. The most ornamental arborescent yucca is the *Alpifolia Menandii*. This plant

reverses the usual form of variations that one observes in agaves and yuccas. The outside edge of the leaf is green, the inside white or yellowish white, and the underside of the leaves almost all white. The plant, I believe, would be hardy, but as it is not, to my knowledge, on sale at any nursery, I have never risked my prize specimen out of doors in winter. *Yucca Aloifolia variegata* has its variegations of yellowish white placed similar to those of variegated agaves, i. e., on the outside edges of the leaves, with an occasional streak of white in the green leaf. This is a tall-growing, beautiful yucca, and is hardy. *Yucca Treculeana* is one of the most ornamental of our hardy yuccas. While its home is Mexico, it is hardy in middle Georgia. Its ultimate size, its shape, the carriage of its foliage, all make it one of the most attractive of yuccas. *Yucca Aloifolia* is the Spanish Dagger of our fathers, and it is the variety that most resembles the tree palmettos of the seacoast. When put in the right place in well planted grounds, its presence adds greatly to the beauty of the landscape gardener's work.

**Yucca Gloriosa.** This yucca is one of the most ornamental of the family. It usually forms a stem and has thinner, longer and more flaccid leaves than the *Aloifolias*. It is local in its habitat, found growing wild near the coast of Georgia and the Carolinas. The first *Gloriosa* I ever observed was at the famous Kew Botanical Gardens, near London. I made a note of the yucca, and wrote Mr. P. J. Berckmans regarding the plant; his answer was that he sent it to Kew some years before. *Gloriosa* is more variable in its habitat of growth than any other yuccas. Some, with me, build a stem or trunk, and some remain dwarf; some have long, broad flaccid leaves, and some have short, more rigid foliage. The leaves of some are plicated, i. e., folded like a fan; others have smooth, plain leaves. Wm. Trelease thinks the *Gloriosa* a hybrid between *Y. Filamentosa* and *Y. Aloifolia*. Its variations in habit of growth go far toward leading one to assign its origin to these two dissimilar yuccas. There are many other large growing yuccas not yet tried out of doors for resistance to cold, and I omit naming many of them that I cultivate. Of the dwarf growers must be named the usual garden forms of *Yucca Flaccida* and *Y. Filamentosa*. Many dwarf growing yuccas are nearly as ornamental as *Dracaenas* when planted in vases, and the yuccas will stand sunshine and shade, cold or heat. While they are thankful for water, they will live without any additional supply than the partial rains afford. In winter, for vases on terraces and porches, yuccas fill a greatly needed want. Agaves of many varieties are most satisfactory summer plants, but are usually winter killed if left out. *Aspidistra lurida* will survive most winters and when in extreme cold it is killed, it usually grows new plants from the roots. While we have a supply almost without limit of summer growing vase plants, we are painfully scarce in hardy winter surviving ornamentals. Hence, additional value is placed on such plants as the

hardy yuccas, *Aspidistra lurida*, *Laurus nobilis*, tree box and a few others for porch decoration. The yucca family is dependent on the moth *Pronuba yuccasella* for the pollination of the blooms. Without the moth, no seed is perfected. Many other varieties of yuccas besides those recommended I have cultivated, but the list named is sufficient for planting except by some person who especially fancies these desert plants, and to him my experience is at his service. The yuccas furnish the Indians with a cleansing substitute for soap. Yucca fruits are still eaten in Mexico by the natives. From the excavations in the homes of the pre-historic cliff dwellers come evidence of the use of the yucca leaves for sandals and mats in the dim past as at present.

#### BROAD-LEAVED EVERGREENS.

Of all the family, to *Magnolia grandiflora* belongs the first place. Its great size, natural fine habit of growth, beauty of foliage and of bloom, all rank it the first among the broad-leaved evergreens. *Photina serrulata*, boxwood, wild olive (the tree growing and the dwarf) the many varieties of *buxas* afford good material to the landscape gardener. The hardy *Azaleas*, *Camellia Japonicas*, so beautiful in flower and ornamental in leaf, *Olea fangrans*, *Osmanthus*, *Berberis japonica*, *Laurus nobilis*, *Kalmia*, *Gardenia*, all these are hardy, and even a small place cannot afford to do without them. The United States Government Citranges are desirable broad-leaved evergreen trees, ornamental in winter garb, attractive during spring blooming, beautiful when loaded with orange-colored fruit during the fall. A grand future is before this tree. In my grounds the surest fruit bearing variety has been the Rusk; its fruit is beautiful, but too sweet for use as lemon or lime, too sour to eat as an orange. The fruit needs developing, both toward more acidity and also toward the sweet orange type. By continued experiments in hybridizing and seed planting, I have no doubt but that the most desirable fruit will be produced. All my citranges have proven practically evergreen, holding their leaves unless the temperature drops very low, when they will shed their foliage. It is a great advance in horticulture to produce an orange tree, evergreen and hardy, ornamental and fruit bearing, suited to grow in a climate where no previously existing orange could survive. Every southern farmer should lend his aid in cross-pollenizing these citranges and plant the seeds in the hope of producing better fruit than has yet been grown from the first cross of the sweet orange and the trifoliolate.

#### DECIDUOUS TREES.

If one were to list the varieties of deciduous trees worthy of cultivation in middle Georgia, he would end with a catalogue of names and consume hours of time. Some are so very desirable for their quick growth, dense shade, ease in transplanting, freedom from insect pests,

that a few should be named by those of us who have had years of experience in tree planting. For the blooming quality, separated from all other considerations, I would give first place to the Chinese flowering magnolias. The higher colored purple magnolia at my place in 1909 furnished blooming flowers in my residence daily from January 1st to early February, when the temperature fell to 10 degrees Fahrenheit. *M. Soulangeana Nigra* succeeds the other in its period of bloom, and the early and late blooming varieties are complementary to each other. Most of the hydrangea family are hardy in the open ground, requiring mulching in winter and summer, and plenty of manure. No flower gives better returns for the space occupied. Altheas, wisterias, lagerstroemias, honeysuckles, pomegranates, lilacs, are all desired when room may be had for them. Among deciduous shade trees the resident of middle Georgia may exercise endless choice in selecting those he prefers. The most rapid grower with me, and one most free from faults, has proven to be our tree wrongly called Sycamore. The scientists affirm that *Platanus Orientalis* or European Button Ball is the best, but this I do not accept. Plane trees have not only the merits of the most rapid symmetrical growth, the thick foliage being a delightful color of green, the leaves shedding clean after the first frost. When bare of leaves in winter, no deciduous tree exhibits more graceful arrangements of limbs. The death of the tree after a few years' growth need not be feared, as has occurred in my grounds with the *Paulownia Imperialis*, its rival in rapid growth. The maples are desirable, and fit in places where trees of smaller ultimate size are required, than oaks and elms. Dogwoods are worthy of more attention than they receive. The elms divide with the *Platanus* family the honor of being most easy to transplant, and a most economical habit it is to the tree planter. I have in mind the planting of the streets of Eatonton by the Ladies' Improvement Society, presided over by Mrs. Hunt. Out of a plant of 1,300 odd woods-grown elms, in one season, many planted in the most unfavorable places, the loss was practically nil. Let us not forget that there are about 18 species and many more varieties, and that certain elms are much more desirable than others. My choice is the *Ulmus americana*. The cork-barked varieties I like less than the others. Among native oaks we have many varieties from which to select. Bailey says there are about 500 different oaks. I prefer the willow oak, *Quercus Phellos*, and water oak, *Quercus lyrata*. The grandest of all of them, the live oak, is not indigenous to the uplands of middle Georgia. The beech, in summer, is a truly ornamental shade tree, but in winter it will cling to its dead leaves, presenting an unsightly appearance. For this reason alone I have abandoned planting it. There are many other American and foreign deciduous shade trees worthy of cultivation, but I could not consume the time necessary to even name those I prefer. Let me insist that in the transplanting of any tree with thin bark, wrapping

the body of the tree with paper or burlaps is necessary to prevent sun scald; the larger the tree, the more necessary the wrapping. Of all the ornamental hedge plants, in shade and sunshine, in good soil or poor, Amoor River privet proves best of all. While no privet hedge alone is efficient as against live stock, it may be reinforced with wire as a stock fence. For this purpose I have stretched wires inside the hedge, where they do not show. For gardens, to exclude chickens, I have used woven wire fencing which the privet soon wholly hides. Its ability to grow in any soil without a missing or diseased or dwarfed plant, and its evergreen quality in winter, places it, in my estimation, above all other ornamental hedges. The northern nurserymen still catalogue and recommend California privet as the best of hedge privets. We who have planted *Ovalifolium* find it inclined to be deciduous; in winter what leaves remain turn dark or bronze, while *Armurensis* remains truly evergreen. Bailey, a northern authority, in his encyclopedia of plants, classes the Amoor River among the most hardy of the privets, hence it cannot be from any defect in the *Amurensis* on account of not resisting the cold. From ignorance of the merits of *Ligustrum Amurensis*, I ascribe the fact that northern nurserymen do not catalogue and estimate this best, instead of an inferior, privet. To P. J. Berckmans belongs the honor of introducing, recommending and disseminating this most desirable of all hedge plants. His catalogue to this day gives a too modest and dictionary-like description of the plant, saying nothing of his instrumentality in benefitting all seekers after the most useful and ornamental. *Citrus trifoliata*, a most desirable, ornamental and deciduous plant, was introduced into this country by P. J. Berckmans, imported from Japan by him in 1876. I use it as a hardy ornamental, placed as a border plant. Beautiful it is when in bloom and still more striking when loaded with golden-colored fruit. As a hedge, it is ornamental as well as a true barrier in its ability to resist cattle. It is a necessity as a stock upon which to graft the citranges, which latter owe their creation to this mother plant. From the necessary length of my paper, to include the tried and proven ornamental plants enumerated I must omit many of the large family of coniferous evergreens and the climbing vines. Let me give credit for the introduction into America of *Biota Japonica filiformis* to the Berckmans family. As I remember, the sons of P. J. Berckmans observed this plant in the nursery of Veitch & Sons, near London. At a very high cost, they bought several plants from Veitch's stock of five. From these have descended all we have of this desirable *Biota*. One of these fruit trees, imported from Europe in 1884, is still growing on my lawn, and in perfect health, while many other cone-bearing evergreens have ceased to stand sentinel and gone without rewarding their planter, with a long and useful life.

To the coniferous evergreens we are as largely indebted for our higher civilization as to the palms for our primitive advance in the arts. Without steel-edged tools our ancestors could scarcely have worked in the hard deciduous woods. The straight-stemmed conifers with soft wood, so strong in proportion to weight, gave them timber for houses, temples and ships. Even to this day is the wood preferred for its quality and lightness in the construction of air-ships.

*Biota aurea nana* I consider the most beautiful of the smaller growing Asiatic arborvitae. *Biota aurea corespicua* is of stately erect habit; *Biota aurea pyramidalis* has proven very satisfactory. All three of these originated in the Berckmans nurseries. With me all the biotas, as well as the large growing California arborvitae have thrived and are free from disease. *Cedrus deodara* and many of the cypress family have succumbed to cold and insects on my grounds, after living several years.

*Podocarpus* and several of the *Retinosporas* have done well in middle Georgia.

Have we ever taken time to think what a service is done to humanity by him who introduces an ornamental or useful plant? Let me say a word for the man usually too modest (as is the habit of the altruist) to speak for himself. He who paints a great canvas, carves a remarkable figure from a block of marble, or designs a Parthenon, may thereby become immortalized. Yet what has he done comparable to the man who has introduced a beautiful and useful plant? The latter may be budded, layered, grafted, multiplied, and become the property of every lover of plant life, benefitting the poor, the invalid and the untraveled.

The first may only be enjoyed by the rich purchaser, and his exclusive friends. At the death of the original owner the work of art may benefit a larger number, if bought by some museum open to the public. Allowing its destination finally to be a great museum in London, Paris or New York, in the most public place possible, even then it may be enjoyed by only the few nearby residents and the world travelers. The work of the artist is constantly exposed to destruction by fire, carelessness or accident. The introducer of desirable ornamental and economic plants puts the world in his debt, whether he be thanked or appreciated in life or after death. It is right and pertinent that we remember these things when we meet to encourage horticulture in this chosen home of ours.

The increase in wealth, shorter hours of labor, economy in time gained by electric driven cars and modern machinery, all have contributed in affording leisure to wage earners, as well as to their employers. With this advance comes a craving for more attractive homes and grounds.

Considered from every point of view, hardy ornamental plants are most desirable and economical. They cost but the original outlay in

money or labor, against daily watering by pet plants, and expensive winter storing required by greenhouse tender ornamentals. If my point of view is correct, no apology is necessary for advocating the extensive use of hardy ornamental plants.

The PRESIDENT: Mr. Hunt has given us a very good paper. On the question of palms, what he says is correct. Never plant a very small palm in the open air. Allow it to get of good size under protection, sufficiently large to resist the inclemency of our winters; and never plant them out in the fall of the year. When you plant them, let it be after all danger of spring frosts is over. There are, however, very few palms that are perfectly hardy in this climate. One of the hardiest is a dwarf palm called the Needle Palmetto. It only grows to five or six feet, and it bristles all over with needles; but it is a very hardy and very beautiful plant. A little lower down we can grow the Cabbage Palmetto if we plant it out when it is of some size. In Savannah, where it is indigenous, you might say, right on the seacoast, they had a few plants of this palm scattered through the city until a few years ago when they beautified the old colonial cemetery; I suggested to them that they would do better to plant a row of these palmettos on each side of one of the streets. They did so, and now have a beautiful avenue of that palmetto. Here I do not believe it would be as successful. The only hardy plants for middle Georgia would be the Needle Palmetto and the Cabbage Palmetto. Outside of those I know of none that would stand our winters. A little lower down the *Chamerops graulis* grows pretty well, but not up here.

Mr. Von HERFF: I want to say a word about the *Washingtonia filifera*. It is one that is very well known in

southern California. In San Antonio they did not have a single palm twenty years ago, and now they have brought this palm there and it is perfectly hardy. It seems to me that things must be tried before judgment is pronounced. Nobody supposed that it would be hardy in San Antonio. It is strikingly different from the yucca. It has a very thick stem, and grows pretty tall. I believe I have the only plants east of the Mississippi river that grow in the United States, and I believe they are absolutely hardy in North Carolina. These plants came from Mexico and were exhibited in St. Louis, and after the exposition was over I asked to be allowed to have some of them; I got three, which were perfectly hardy, have been standing the winters of North Carolina, where it is much colder than here. That shows that a thing must be tried before it can be pronounced upon.

Mr. HUNT: There seems to be a species of yucca known as the *Samuela* which is said to be very hardy, but the question is, will it live out of doors? I have just ordered one from Italy.

Mr. Von HERFF: Yes, it will. I remember one winter when it was 10 to 20 degrees below zero, the plant was frozen down, but it grew out again and it is now growing nicely. There are two species of *Samuela*, the *Carmerosana* and the *Faxoniana*. The *Carmerosana* grows in Mexico, the *Faxoniana* in the United States. The Mexican species is very hardy; they have imported a carload of these into western Texas, where they are hardy.

The PRESIDENT: I regret that we did not have more ladies present to hear the beautiful essay of Mr.

Hunt. He has given us a very interesting paper on hardy plants for ornamental purposes which are being grown in middle Georgia. At this point I wish to say that I hope we will be able to have all these papers appear in print. They are not only interesting from a scientific standpoint, but they are educational and elevating to us in every way. The only thing I can do is to ask every member present, as Mr. Waernicke suggested, to try to bring at least five new members to our next meeting. We have very little support, we have no State aid, and of course we have to get out the size of our volume according to our finances. So, if you will aid us by adding to our membership, we will print these papers in full. We have two more papers before us. One is upon the benefits which have been derived from the work of the Fruit Exchange, by Mr. Fleming, and the other is on the control of the brown rot, by Prof. Ayres. These two papers are co-related; one will show you how to control the brown rot, and the other will show you how to best dispose of your fruit. I will introduce now Mr. Morgagne Fleming, who will read his paper.

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### **THE BENEFITS WHICH HAVE BEEN DERIVED FROM THE WORK OF THE FRUIT EXCHANGE.**

By L. M. Fleming, Manager Georgia Fruit Exchange, Atlanta, Ga.

Agreeable with the request of your honored President that, in my capacity as Manager of the Georgia Fruit Exchange, I review the benefits of the Exchange to the members and the State at large, it affords me great pleasure and I consider it quite an honor to have this opportunity of appearing before you, and to listen to the scientific discussion of subjects so vital to the orchardists.

It is to be hoped that these questions, such as spraying for insects and fungus diseases, the search for the heretofore hidden cause of

brown rot and the remedy for the same, may be worked out on practical lines; for based only on careful and scientific work can any grower hope for success in fruit culture.

As to the peach crop for 1909, one would believe that on account of the light crop it would have been of extra fine quality; however, one of the oldest growers in the point of experience remarked that the 1909 crop has been the worst, as a whole, in his entire experience of 18 years. Experts attribute this, in a way, to the concerted attack of the various diseases on the light quantity of fruit on the trees and, further, on account of the depleted condition of the trees after the very heavy crop of 1908.

I mention these details of condition and quality of fruit as it has such an important bearing on the successful operation of any marketing plan, and further to make the suggestion that, unless the orchards are taken in hand more systematically, and placed on a business basis from the standpoint of cultivation, co-operative marketing organization cannot be of the same value. A value must be created for any article before it is fit for the market, and that value is going to be determined by an expert when you expect to sell the car f. o. b.

On the other hand, if you expect to consign to the markets and pay the high transportation charges, it is equally as important that you examine this fruit from the standpoint of an expert before the shipping is undertaken, and see if, in your opinion, it will stand five days of transportation. That is what the buyer has to consider before he puts up his money in an f. o. b. purchase, but in your case you have already put your money in your orchard investment, and there is no use to deceive yourself with the idea that you are sending out a first-class car of fruit, when you know you are not. The man at the other end can't be fooled, even though he was not raised on a farm.

When I refer to this crop of fruit as being the poorest in quality in 18 years, it, of course, carries with it an exception of various orchards which could be mentioned by name, which goes to prove that care and attention to details of cultivation are the first requisites to a money making investment, and the cases referred to as exceptions in the 1909 crop should be "shining lights" to mark the way to net results in orchard investments.

The Georgia Fruit Exchange is composed of over 600 members scattered through the various peach-growing districts in the State, including some of the adjacent territory of Alabama and South Carolina. These members were brought together by one certain bond of union if by no other, namely, the disastrous results in marketing the tremendous crop of 1908, 6,000 cars; said results being due to an utter lack of any plan of distribution in the various markets. The crop of 1909 is between 2,000 and 2,100 cars, little more than one-third of the 1908 crop, and it is freely estimated by conservative growers that this crop has

practically netted more money to the State than the bumper crop of 1908, due to better prices prevailing in the markets and the unprecedented f. o. b. buying at the shipping stations.

By the system of limiting the number of houses selected in the markets to act as selling agents for the Exchange, other houses who had previously made a specialty of Georgia peaches became f. o. b. buyers, and to such an extent that the houses selected as selling agents on commission had to enter the f. o. b. market to procure their supplies.

The following is a list of the markets which were used in the distribution of the 1909 crop:

#### SHIPMENTS OUT OF THE STATE, SEASON 1909.

New York . . . . .	860	New London . . . . .	1
Philadelphia . . . . .	368	Cincinnati . . . . .	75
Newark . . . . .	35	Chicago . . . . .	56
Baltimore . . . . .	72	Cleveland . . . . .	32
Washington . . . . .	20	Columbus . . . . .	23
Richmond, Va. . . . .	1	Detroit . . . . .	8
Erie . . . . .	2	Toledo . . . . .	3
Scranton . . . . .	22	Indianapolis . . . . .	6
Pittsburg . . . . .	103	Youngstown . . . . .	1
Buffalo . . . . .	19	St. Louis . . . . .	21
Elmira . . . . .	2	Milwaukee . . . . .	2
Schenectady . . . . .	6	Grand Rapids . . . . .	1
Albany . . . . .	11	Akron . . . . .	1
Rochester . . . . .	1	Dayton . . . . .	3
Syracuse . . . . .	4	Springfield . . . . .	2
Utica . . . . .	12	Bloomington . . . . .	1
Glenn Falls . . . . .	1	Peora . . . . .	2
Troy . . . . .	1	Rockford . . . . .	1
Auburn . . . . .	3	Evansville . . . . .	6
Toronto . . . . .	3	Louisville . . . . .	10
Boston . . . . .	108	Danville, Ky. . . . .	1
Providence . . . . .	42	Nashville . . . . .	4
Worcester . . . . .	6	New Orleans . . . . .	21
Pittsfield . . . . .	6	Savannah . . . . .	2
Waterbury . . . . .	2	Americus . . . . .	1
Norwich . . . . .	1	Jacksonville . . . . .	2
Hartford . . . . .	15	Wheeling, W. Va. . . . .	1
Springfield . . . . .	23	Muncie, Ind. . . . .	1
New Haven . . . . .	5	Atlanta . . . . .	1
New Britain . . . . .	2	Houston, Tex. . . . .	1
North Adams . . . . .	1		
Bridgeport . . . . .	15		
		<b>TOTAL . . . . .</b>	<b>2,062</b>

The 6,000-car crop for 1908 was marketed in a fewer number of cities than this year's crop, which accounts in a great measure for the higher prices which prevailed this year. New York received less than 42 per cent. of this year's crop, as against about 65 per cent. of the 1908; Philadelphia received less than 18 per cent., as against a much heavier percentage in 1908. Chicago, Cincinnati, Cleveland, Buffalo, Pittsburg, and other western markets were supplied direct, illustrating the idea that by supplying direct the eastern and western markets, either by f. o. b. sales or direct consignments, a healthier market condition in New York and Philadelphia is brought about, and, in connection with this direct shipment to the smaller markets, the New York commission houses have complained very strongly that the smaller markets, such as Albany, Troy, New Haven, Hartford, Bridgeport, and other interior New England points, have been supplied direct and have disappeared as buyers on the New York market.

Isn't it far better to supply these people direct and cut out the middleman's profit, than to have the New York market glutted to the extent that all of these nearby markets would come in and buy carload lots that are never even opened at the regular market house on Pier 29, New York, at prices about equal to the cost of transportation, and ship to their home markets and realize handsome profits?

All of this advantage gained to the grower is of equal disadvantage to someone, and if, in the evolution of the trade, the New York commission man happens to be the one who is hurt, it is unfortunate for him; but the grower must take care of himself, instead of working from a sentimental standpoint in favor of some commission house which has led him to believe, in the past, that his fruit is already sold to a discriminating trade before it is out of the bloom.

This influence of the commission man has been so strong that we had the greatest difficulty in overcoming it in the organization of the Exchange; and it is so marked at the present moment, in New York, that we read in the trade papers that the New York commission houses propose to use their influence to disrupt the Exchange; and, as one of our members who was on the New York market reported last week that he did not find anybody against the Exchange except the commission men, and they were a unit in their opposition, he saw in this opposition the best argument and evidence that the Exchange was working good results for the grower. In other words, we cannot help one class without doing a corresponding measure of injury to another; if that injury, however, consists of transferring dollars representing hard licks on the part of the grower, to his pocket, we can satisfy ourselves that it is landing where it belongs.

We have only to consult cause and effect; the cause is the new condition confronting the commission men, of having to buy f. o. b., and the effect is the reasonable profit going into the pockets of the grower, and the gradual elimination of the middle man.

It is a conservative estimate that over 75 per cent. of the fruit, with varying quality, was purchased f. o. b. this year by the trade, and at prices prevailing which were practically above the highest prices ruling in the leading markets. This was due to the fact that the best fruit was being bought so fast that the demand for good fruit could hardly be supplied.

This f. o. b. demand was never equalled before, for the reason that there had never been any organized plan to encourage the buyers to operate; but the plan of the Exchange agreed to withhold consignments to such markets where the capacity of that market was bought f. o. b.

In some instances there were gluts in the New York and Philadelphia markets, due to heavy f. o. b. buying, each buyer operating independent of the other and the non-Exchange member who always shipped to New York, and especially this year, expecting to reap the benefits of the efforts of his more enterprising neighbors who had organized the Exchange; and, right here, it would not be amiss to state that there have been some very difficult cases to understand, where intelligent and apparently broad-minded men have deliberately held out from participating in the efforts of the growers to successfully carry out the purposes of the Exchange, while enjoying all the benefits of the protected markets and f. o. b. buying to the fullest extent.

It is pleasing to be able to say that some of these, having particular reasons of their own for holding out this season, have expressed themselves as anxious to donate their just share of the expenses of the organization; while others call for the strictest accounting when some of their small shipments by accident get into an Exchange car and they unknowingly contribute a commission of a few cents; but human nature cannot be accounted for.

The financial plan under which the Exchange was organized and operated this season, was the most reasonable one possible: A member had to subscribe to not less than one share of stock, \$10.00, part of the \$50,000.00 capital stock. The income to the Exchange was derived from a division of the 10 per cent. commission charged by the selling agent (and in the case of large shippers this commission charge had been 7 per cent. in the past), and where shippers were sold f. o. b., 5 per cent. commission was paid the Exchange by the member.

The annual report of the Exchange has not been closed up in full, but the operations for the year will show a good net earning, despite the small crop. The shippers agree that the markets have been advanced anywhere from 50 cents or more per crate by the Exchange's existence, and that there has never been such a strong f. o. b. market in the State before.

The original organization of the Georgia Fruit Exchange, by contract, covered only the 1909 peach crop. A stock company was formed

and is now on a good basis, and re-organization will have to be perfected; and this should cover a period of from three to five years, with sufficient safeguards to enable the Exchange to tighten the control over the marketing plans to such an extent as to perfect it in every possible way.

The present organization is composed of the shippers of about 90 per cent. of the 1908 crop.

I would consider an Exchange, for a few years, composed of 75 per cent. of the crop, and membership limited to such scientific and careful growers as will enable the Exchange to place a desirable article on the market, as more desirable than an Exchange composed of 100 per cent. of the crop, as there will always be an undesirable element who do not keep up their orchards and are careless in their packing-house methods, and will always remain a menace and drawback to the progressive growers. This element should not be allowed in any Exchange until they can qualify by growing and putting up marketable fruit.

The Exchange has been able to assist very much in improving the transportation methods of handling the peach crop. They have exercised a supervision over all features of the movement, both as to icing and schedules, and the results have been gratifying and can be improved in future by still closer organization on the part of the growers and shippers of perishables, especially peaches and cantaloupes.

The cantaloupe growers have been made to realize more than ever this season the necessity for co-operation and membership in the Exchange; also the watermelon interests, and it is firmly expected that they will be members another season.

The annual meeting of the Exchange takes place in October, at which time carefully prepared reports of the operations will be submitted, giving net results, et cetera, for the season; and it is expected that no difficulty will be encountered in organizing with a stronger membership than the past season.

One of our prominent growers, member of the Organization Committee, remarked to a meeting of prospective members, that he believed one or more years' successful working of an Exchange would bring a grower to the point where he would realize that his orchard was an asset instead of a liability; and, on that line, it occurs to me that where heretofore the grower has had to put himself in the power of the commission man when he wanted ready money to properly cultivate his crop, the banks in the country could protect themselves and keep the money at home in safe investments by loaning the money to responsible growers who can show that they have a safe marketing plan for realizing values after the crop has been raised.

It is a matter of record that there has not been a complete crop failure in Georgia for ten successive years, so that, if it can be reasonably assured that the crop can be grown as this record does show, and

the marketing plan to get the value of the crop, it looks like a reasonably safe investment for a bank.

Every grower who has to borrow money from a commission man has strings tied to him to the extent that he cannot co-operate fully in any marketing plan; and the benefits to the State at large can be greatly increased if it were possible for such growers as must borrow money to get it at home.

I fear that I have trespassed too much already on your valuable time, but I feel that the opportunity of conveying to the people of our State the great benefits that have already been derived, and those that can be counted on in future, justify the time you have so cheerfully given.

I thank you for your attention.

The PRESIDENT: I will now introduce to you Prof. W. T. Ayres, who came to you at my request made last year to Prof. Waite, Pathologist of the Department of Agriculture, and who stated that whenever he arrived at the conclusion that their experiments on the line of brown rot had come to some satisfactory result, he would let me know. About two weeks ago he wrote me that Prof. Ayres who was assistant to our former Entomologist, Mr. Scott, would be at our meetings and would give you the result of the work that they performed this summer at Fort Valley. He said that he was in hopes that the brown rot was now pretty well under control; I hope that this is so true that hereafter we will be free of that scourge in our peach growing.

Prof. Ayres will now address you.

## THE CONTROL OF THE PEACH BROWN ROT.

By W. M. Scott and W. T. Ayers, U. S. Department of Agriculture.

### INTRODUCTION.

At practically every meeting of this Society during the past fifteen years the subject of peach brown rot has held a prominent place in your discussions, and there has been a constant clamor all over the Eastern United States, where peaches are grown, for a practical remedy

for this disease. There is perhaps rarely a season in which the loss from brown rot in Georgia alone does not reach the sum of \$1,000,000. This loss is occasioned not only by the reduction of the crop in the orchard, but by the deterioration of the fruit en route to market, and after it reaches the market as well.

Until recently we have been powerless to prevent this loss, and could only suggest that the sufferers gather and burn the mummies, prune the trees to open heads, admitting sunlight, and, in extreme cases, to spray with Bordeaux mixture at the risk of defoliating the trees. Now, however, after years of investigation, we can offer a real, tangible remedy in the use of self-boiled lime-sulphur.

### PREVIOUS EXPERIMENTS.

Work with sulphur sprays as a possible remedy for brown rot was begun while the senior writer was your State Entomologist, but the self-boiled mixture was not tested until 1907. During that year the writers conducted experiments in Missouri with the result that only 10 per cent. of the crop on sprayed trees developed rot, while 70 per cent. of the crop on the untreated block rotted. These results were published in Circular No. 1 of the Bureau of Plant Industry. In 1903 more extensive experiments were conducted at Marshallville, Ga., Bentonville, Ark., and Neoga, Ill., with about the same good results as were obtained the previous year. An account of these experiments was published in Circular No. 27 of the Bureau of Plant Industry, and the treatment was recommended for general use in peach orchards where brown rot and scab or black spot occur. Experiment Stations and State Boards were especially advised to give the treatment a trial. Your own Board of Entomology speedily took the matter up, and we are informed that excellent results were obtained from their experiments this season, on the orchard of Betts Bros., at Woodbury, Ga., under the direction of Mr. A. C. Lewis, Assistant Entomologist.

### PREPARATION OF SELF-BOILED LIME-SULPHUR.

The mixture is composed of 8 pounds of good stone lime and 8 pounds of sulphur to each 50 gallons of water, and is prepared according to the following directions:

Place the lime in a barrel and pour on enough water to almost cover it. As soon as the lime starts to slake, add the sulphur. The slaking of the lime will generate enough heat to boil the mixture several minutes. Add more water to keep the mixture wet through, but not enough to cool it before the lime is thoroughly slaked. Considerable stirring is necessary to prevent burning. When the boiling has ceased, add enough water to cool the mixture and prevent further cooking. If the hot mass is allowed to stand twenty or thirty minutes, the sulphur will gradually go into solution and produce a caustic mixture which would likely injure peach foliage. The object is to make a good me-

chanical mixture of the lime and sulphur, dissolving only a very small quantity of the latter. It should be strained through a sieve of about 20 meshes to the inch, to take out the coarse particles of lime, but the sulphur should be carefully worked through the strainer with a paddle.

The mixture can best be prepared in large quantities, say enough for 200 gallons at a time. The formula would then be 32 pounds of lime and 32 pounds of sulphur to be cooked with a small quantity of water (about 8 or 10 gallons), and then diluted to 200 gallons. In applying it, the mixture must be kept thoroughly agitated, and we would recommend the use of a gasoline power sprayer with a propeller type of agitator.

#### COMMERCIAL TEST.

Until this year the work has been done in an experimental way on small plats, and in order to place the treatment on a practical basis it was necessary to make a commercial test in which large blocks should be treated. Accordingly, a block of about 5,000 trees in the Hale orchard at Fort Valley, Ga., was sprayed by the Department during the past season. This orchard was selected because it offered almost ideal conditions for the work. The crop the previous year was largely lost on account of brown rot and curculio, and the conditions were such as to make the test about as severe as could be had anywhere. Mr. Hale furnished the teams and labor, and the Department supplied the materials and the spraying apparatus. The junior writer spent the entire season at Fort Valley making the applications and noting the results.

In our first experiments in 1907 it developed that in order to control brown rot it was necessary to prevent peach scab or black spot. It became equally apparent that for the best results against this disease the curculio must also be controlled, although in some cases we were able to hold the rot down to about 10 per cent. without treating for curculio. Therefore, on one of the blocks at Fort Valley, arsenate of lead was used in connection with the self-boiled lime-sulphur as a combined treatment for brown rot and curculio.

This work was done in co-operation with the Bureau of Entomology, under the direction of Mr. A. L. Quaintance, in charge of Fruit Insect Investigations.

We will not take time to discuss the experiments in detail, but will give a summary of the treatments and results, pointing out the more important features.

Plat 1, consisting of 538 Waddell trees, was sprayed with self-boiled lime-sulphur, first on April 30th, about a month after the petals dropped, and, second, on May 20th, three weeks later. The fruit from five trees, including drops, was sorted and counted, with the result that 17 per cent. was found to be affected by brown rot, and 16 per cent. slightly affected with scab. An examination of the brown rot fruits showed that 93 per cent. of it was caused by curculio punctures, and

that, aside from the curculio work, only 1 per cent. of the crop was affected with brown rot.

The check plat consisted of 1,357 trees, and the counts on five trees showed 49 1-2 per cent. of the crop affected with brown rot and 91 1-2 per cent. affected with scab, a third of which was so badly affected that it was unmerchantable. This shows a difference in favor of the sprayed block of 32 1-2 per cent. on rot and 75 1-2 per cent. on scab. In this case 80 per cent. of the brown rot infections was apparently caused by curculio punctures.

Plat 2 was a block of 1,275 Waddell trees sprayed only once, April 30th. The counting record of the fruit from five trees shows 12 1-2 per cent. affected with brown rot, and 32 per cent. affected with scab, only a few specimens of which were bad. Here, again, 84 per cent. of the brown rot infections was due to curculio.

A record of the sorting packing-house was also kept. The crop from plat 1 (568 trees sprayed twice) yielded 183 1-3 crates of good fruit, and 24 1-2 bushels of culls, or about 13 per cent. culls.

Plat 2 (1,275 trees sprayed once) gave 444 crates of good fruit, and 74 1-2 bushels of culls, or 17 per cent. culls.

The check plat of 1,357 trees yielding only 219 1-3 crates of good fruit and 83 bushels of culls, or about 38 per cent. of the fruit brought into the packing-house was discarded as culls.

The crop was light in the orchard, and the yield was not large in any case, but the fact that 444 crates were packed from 1,275 sprayed trees and 219 1-3 crates from 1,357 unsprayed trees shows that the spraying more than doubled the yield of merchantable fruit per tree.

You have seen from the above figures that the scab or black spot was almost entirely prevented and that brown rot was materially reduced; but complete success in the control of brown rot was rendered impossible by the interference of the curculio. The following data will show the remarkable effect of the combination of self-boiled lime-sulphur and arsenate of lead for the control of brown rot and curculio.

Plat 6, consisting of 1,100 seven-year-old Elberta trees, was sprayed, first, on March 31st (as the calyces were shedding), with arsenate of lead, 2 pounds to 50 gallons of water; second, on April 22nd, with 8-8-50 self-boiled lime-sulphur and 2 pounds arsenate of lead; third, on May 21st, with self-boiled lime-sulphur alone; and, fourth, on June 9th, with self-boiled lime-sulphur. The cost of materials, labor and team was \$62.38 or 5.6 cents per tree.

When assorted and counted, the fruit from five trees had only 4 1-2 per cent. affected with brown rot, about half of which was caused by curculio. On 6 1-2 per cent. of the fruit showed scab marks, and these were mostly small inconspicuous specks. The curculio infestation was 27 1-2 per cent.

From this block 327 1-4 crates of fine fruit were packed, and there were 31 1-4 bushels of culls.

The check was composed of 1,224 Elberta trees adjacent to the sprayed block, and of the same age and growing under the same conditions. The only difference in the two blocks was that one was sprayed and the other was not. In this unsprayed block, according to the counts of the fruit from five trees, 63 per cent. of the fruit had brown rot, 99 per cent. was affected with scab, and 97.1-2 per cent. wormy.

Although this block had more trees by 124 than the sprayed block, and at the beginning of the season had just as good a crop of fruit, it yielded only 33.3-4 crates of good fruit. Aside from the loss in the orchard, 45 bushels of culls were thrown out at the packing-house.

The crop was very light in both blocks to start with, but the spraying held the fruit on the sprayed block, while the unsprayed block lost its crop almost entirely.

#### SHIPPING TEST.

In order to determine the difference in the carrying quality of the sprayed and unsprayed fruit, two test cars of peaches from the experiment plats were shipped to New York, examined on arrival and sold in the usual way through a commission house. The fruit in the first car was picked on Friday, July 9th, in the rain, and although due on the market Tuesday morning was delayed en route, and was not sold until Wednesday morning. The market was almost glutted with poor fruit and the prices ranged low. The test car contained Elbertas and Belles—sprayed and unsprayed. The sprayed Elbertas from the lime-sulphur-arsenate of lead block sold for \$2.00 a crate, and the unsprayed Elbertas from the adjacent unsprayed block sold for \$1.50 a crate, making a difference of 50c a crate. The sprayed Belles sold for \$1.25 a crate, and the unsprayed Belles for \$1.125. An examination of the Elbertas showed that 34 per cent. of the unsprayed fruit was specked with brown rot, while only 6 per cent. of the sprayed fruit was affected.

The second car arrived Wednesday night, and was sold Thursday morning, July 15th, at the following prices:

Sprayed Elbertas at \$1.45 per crate.

Unsprayed Elbertas at \$1.25 per crate.

Sprayed Belles at \$1.50 per crate.

Unsprayed Belles at \$1.14 per crate.

This shows a difference of 20 cents a crate for the Elbertas and 36 cents a crate for the Belles. Another significant fact is that all the sprayed fruit in each case was sold before the buyers began purchasing the unsprayed fruit. It will be seen that the difference in market value in favor of the sprayed fruit, to say nothing of the loss in the orchard, pays the cost of spraying several times over.

### COST OF TREATMENT.

The spraying was done with a gasoline power sprayer, equipped with a 200-gallon tank and propeller agitator, two 25-foot leads of hose, and double Vermorel nozzles. The mixture was prepared in quantities of 32 pounds of lime and 32 pounds of sulphur in a barrel with a small quantity of water, then strained into the spray tank and diluted to 200 gallons. With one man to prepare the mixture and drive the supply tank, and three men (negroes) to operate the spraying outfit, 900 to 1,000 mature trees were sprayed in a day. The cost was 11-5 cents to 13-5 cents per tree for each application, or an average of 41-5 cents per tree for three treatments. The combination lime-sulphur-arsenate of lead treatment cost 53-5 cents per tree for four applications. Where labor is higher and working hours shorter, the cost would, of course, be greater, but if an expenditure of even 10 cents a tree will increase the yield 25 per cent. to 50 per cent., and in addition enhance the market value of the fruit 25 cents to 50 cents a crate, the cost would seem insignificant.

### DANGER OF INJURY.

If the self-boiled lime-sulphur is properly prepared, there is no danger of injuring the fruit or foliage and even when carelessly prepared, the danger of injury is not great. In all our work this year not the slightest injury developed on any of the several thousand trees sprayed.

Arsenate of lead, however, sometimes injures the peach, and for that reason it has not been generally recommended for use on this fruit. No injury whatever occurred on the block which we sprayed with the poison at Fort Valley, and from the evidence at hand it seems that in the majority of cases where arsenate of lead has been used on peaches no injury has occurred.

### RECOMMENDATIONS.

In view of the fact that arsenate of lead occasionally injures the fruit and foliage of peach, we would not recommend it without due caution. However, since the control of the curculio is a necessary step in the treatment of brown rot, peach growers can probably afford to take some chances in the use of arsenate of lead. Self-boiled lime-sulphur alone will entirely control peach scab and will control brown rot when the curculio does not interfere, but it cannot overcome the infections which take place through the punctures of this insect. Arsenate of lead is therefore included in the course of treatment recommended below, with the approval of Mr. A. L. Quaintance, who has for several years conducted experiments for the control of the curculio.

For Elberta, Belle and other varieties of the same season, the following course of treatment would seem advisable, judging from the results discussed above:

1. About the time the calyces (or shucks) are shedding, spray with arsenate of lead, 2 pounds to 50 gallons of water.

2. About three weeks later spray with the self-boiled lime-sulphur, 8-8-50, and 2 pounds arsenate of lead to each 50 gallons.

3. About a month before the fruit ripens, spray with self-boiled lime-sulphur alone, omitting the arsenate of lead.

In orchards where the curculio is not a serious pest, the arsenate of lead should be omitted and the trees should be sprayed with self-boiled lime-sulphur about a month after the petals fall, and a month before the fruit ripens and half-way between those dates.

For earlier varieties, such as Waddell, Carman and Hiley, spray (1st) when the calyces are shedding, with arsenate of lead 2 pounds to 50 gallons of water; and (2nd) about three weeks later with self-boiled lime-sulphur and arsenate of lead, 2 pounds to 50 gallons of the mixture. In wet seasons bad rotting varieties will require a third application about three weeks after the second.

Mr. L. A. BERCKMANS: I would like to ask Prof. Ayres what have been the results of his experiments on the San Jose scale?

Prof. AYRES. We do not know yet just exactly what the effect is, but last year, in Arkansas, an orchard was selected where the scale was very bad. On the sprayed trees the foliage stayed on, while on the unsprayed trees the fruit and the foliage were lost on account of the scale. That is the only instance with which we have had any experience so far.

Prof. McHATTON: Did you ever try your spraying for brown rot on the Alexander variety of peaches?

Prof. AYRES: No, sir, but we tried it on the Red River, which is about as bad as the Alexander. We had very good success. Twenty-five per cent. of the unsprayed fruit rotted, while on the sprayed fruit we reduced it to about ten per cent.

Mr. ROWLAND: I would like to ask if it would be practical for the Society to publish the papers of Mr. Ayres and Mr. Fleming that we have just heard?

The PRESIDENT: We will do our best, Mr. Rowland; we will endeavor to have these papers, and all the others, before the next meeting, which is to be held in January. The only difficulty standing in the way is the condition of our treasury.

Mr. ROWLAND: In case these papers are published, including Mr. Hunt's, I would like to make a motion that a number of copies be sent, with the compliments of this Society, to the ladies of the Garden Club of Athens.

The motion was duly seconded and carried.

Mr. ROWLAND: I would like to move, that if any of the proceedings of this meeting are published, Mr. Ayres' report be included in it.

The PRESIDENT: We will make a strong effort to have some pecuniary assistance from the State and also from the U. S. Department of Agriculture. I will take great pleasure in submitting the matter to Secretary Wilson, as he is always eager to help us in any way he can.

Mr. MORRILL: I am a member of the Horticultural Societies of about a half dozen States in the United States. I have met with this Society a number of times, but I have never been a member of it until today, although I have been living in Georgia since 1878. In order to get these papers published, I will be one of ten, or five, or whatever may be necessary to publish these reports, to give \$10.00 towards that object.

Mr. LEWIS: I might say that there is a bill before the Senate now, appropriating \$10,000.00 to the State Board of Entomology; and if that bill passes the Senate, we can publish these proceedings.

Mr. HUNT: I do not want this to get to be a begging meeting. I do not think we ought to ask our individual members to go into their pockets; we will accept evidence of their good will in some other form, but not in that way.

The PRESIDENT: Mr. Lewis, who is our Assistant State Entomologist, is before you, and desires to read a part of Mr. Worsham's paper.

Mr. LEWIS: Mr. Worsham was not able to be here on account of this pending bill, and he wanted to get it through if possible. I think it is the most important measure that has come before the session, and it looks now as if we will get the appropriation; and if so, we will publish the proceedings as we did last year. Mr. Worsham's paper is on "Peach Insects, their History and Control," but I will not take up your time to read all of it. We have made experiments on curculio for the last three years, and I will read that part of the paper relating to this particular subject.

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### PEACH INSECTS.

By E. L. Worsham, State Entomologist.

The insect enemies of the peach cost the State of Georgia about two hundred thousand to four hundred thousand dollars whenever we have anything like a full crop. The greater portion of this injury can be prevented if the recommendations of the various entomologists, who have worked on these problems, are adopted.

In fighting peach insects there are a few general directions that may be followed, but it is well to know what the insect is, what its life history is, what is the best time to fight it, and what is the best insecticide to employ. Unless these points are known, warfare on insects is a waste of time and money.

When an entomologist recommends that certain results can be expected from the application of certain insecticides, the recommendation is made after a careful study of the insect, and after having conducted very careful experiments; but if you expect to obtain similar results, directions must be very carefully followed. If you deviate from these you are liable not only to fail to kill the insect, but you are liable to injure the tree.

Of all the industries in Georgia which are dependent upon the State Board of Entomology, the peach industry is the most dependent. Without the careful investigations which have been made by the State Entomologist and his assistants, the beautiful, blushing Georgia peach would not have lived to place Georgia among the foremost peach-growing sections of the world. The San Jose scale would have made peach growing impossible if we had not learned to check its ravages by methods which are simple, and which can be applied by any peach grower.

There are about twenty-five insects which attack peaches, but in a paper of this kind I think it best to touch upon just a few of the most important ones.

#### SAN JOSE SCALE.

The San Jose scale is by far the most serious pest the fruit grower has to contend with in Georgia. It was introduced from California in about 1889, and since that time has spread through practically every fruit growing section of the State. It is responsible for the great advancement made in America in economic entomology. When it began its ravages in California it was seen that unless some means could be devised to check it, it would be absolutely impossible to grow fruit. Legislatures began to be liberal in appropriating money for its investigation, and while today it is a most serious pest, it is one of the easiest to control if the directions of the investigators are followed.

Perhaps those of you who are not familiar with the little insect would be interested in knowing something about it. To the naked eye it is a most harmless looking creature. It is very small; the female being more or less round, and the male more or less elongated. They are both rather darkly colored, being dark at center and somewhat lighter towards the edge. Both have a distinct wax covering, which is secreted by the insect. The covering resembles a small scale, and for this reason insects of this type are called scale insects. Beneath this scale is a very highly organized insect. It belongs to the sucking

class of insects, and is provided with proboscis or sucking apparatus, which is thrust into the tissue of the plant for the purpose of extracting the plant juices for food.

#### LIFE HISTORY.

At this latitude there are about four distinct broods or generations. They really continue to breed until the cold weather of December and January. The most interesting thing about San Jose scale is, that it is capable of reproducing parthenogenetically, or without pairing. The female never emerges from under the waxy scale. The male is quite small, and when it emerges is capable of flight. All the scales die in winter except those that are one-third grown, and one-half of these are killed by cold weather.

Were it not for other agencies this insect would never have gotten into this country, and even after it was introduced, it would have traveled so slowly that it would probably have taken a hundred years to travel across the continent. Unfortunately, however, it is carried from one place to another by various agencies.

Birds and insects play a large part in the distribution of scale insects. They are carried on the feet of birds, and on the feet of other insects. When once started in an orchard the young get into the clothing of the people cultivating the orchard, and likewise upon mules and horses which come in contact with infested trees.

#### NATURAL ENEMIES.

San Jose scale has quite a number of natural enemies which prey upon it, and in some sections of the country are sufficient to hold it in check. Among the most effective natural enemies are small lady beetles. When this pest was traced to China, it was discovered that it was really not a pest there on account of the little Asiatic lady beetles, which kept it in control. Efforts were made to establish these little fellows in this country, but all attempts failed. Conditions are not favorable here for their development.

In addition to the lady beetle, there are very small, wasp-like insects which are parasitic on scale, and which, under certain conditions, destroy a large per cent. of them. In the line of parasites, the fungus diseases are some times very effective. San Jose scale and many other scale insects are sometimes held in control, in Florida and other semi-tropical sections, by fungus diseases.

In Georgia we can not rely on natural enemies to do the work for us; we must fight it ourselves. It is no longer a question of whether we shall fight, but when we shall fight and what we shall fight with.

#### REMEDIES.

Almost every known remedy that has been successful in controlling insects has been used on the San Jose scale, but after much experi-

menting we have discovered a remedy on which we can rely for almost perfect results. The remedy to which I refer is home-made lime-sulphur wash, 20 pounds of lime, 15 pounds of sulphur, 50 gallons of water. Careful directions for its preparation can be obtained on request to the State Entomologist, Atlanta.

It does not hurt the tree if applied in the fall or winter while the tree is dormant, and one application a year, if thoroughly made, will be sufficient to keep the scale in control and prevent any injury to the tree. The fungicidal value of lime-sulphur is not to be overlooked in selecting remedies for scale. We have demonstrated that it will prevent leaf curl, and no doubt has some effect on brown rot. Its caustic properties make it more or less objectionable to handle, but its double value as fungicide and insecticide will serve to keep it in the lead as a remedy for scale.

Recent experiments seem to show that the prepared lime-sulphur is practically as effective as the home-made preparation. In the prepared lime-sulphur, the lime and sulphur are concentrated, and all the grower has to do is to dilute with water and apply to the tree. In our experiments the dilution of one to nine or one to ten, seemed to give best results. This has some advantage, in that it is much less trouble and is more easily applied. There will be practically no difference in the cost between the two. At a cost of not more than one and one-half to two cents per tree, any one can keep his trees from being damaged by the scale.

#### WEST INDIAN SCALE.

West Indian scale is quite destructive to peaches in some sections of Georgia. Fortunately it is not widely distributed. It occurs in only a few localities. Its life history is somewhat similar to that of San Jose scale, and the same remedies can be relied on for its control.

#### PEACH LECANIUM.

There is also a soft scale or "Lecanium" which is sometimes quite abundant on peaches, but as a rule not very destructive. It is known as "Peach Lecanium" or "Turtle-back scale," and can be controlled in the same way as San Jose scale.

#### PEACH TREE BORER.

Next to San Jose scale, perhaps the greatest injury to peach trees in Georgia is done by the borer, which attacks the roots. There are a number of borers attacking peach trees, but this one attacks only the roots, and is technically known as "*Sannina exitiosa*." Its presence is detected about the base of the trees by the exudation of gum from points of attack. Great masses of gum often extend entirely around the base of infested trees. When they are abundant they suc-

ceed in girdling the tree, and its vitality is necessarily interfered with.

This borer belongs to the order "Lepidoptera," but externally the adult resembles very little the other members of this order; for they resemble wasps in shape and size, and are often mistaken for them. The adults appear mainly during the latter part of August and the first part of September. Very soon after emerging, the female begins to deposit eggs on the trunk of the tree. The eggs soon hatch into tiny worms, which begin to bore into the bark near the ground, causing an exudation of gum. When full grown, these worms are about one inch in length; yellowish-white in color, with the head and first body segment brown. When full grown the worm, or larva, leaves its channel in the tree and constructs a cocoon at the surface of the ground near the base of the tree from which it emerges and changes to chrysalis, or pupa, in the cocoon. From the cocoon, the adult moth issues, escaping from the pupal skin, which is usually left attached to the cocoon.

#### REMEDIAL MEASURES.

No spray, no wash, and no remedial measures have ever been successful in fighting this insect in the South. Prof. H. N. Starnes, former Horticulturalist of the Georgia Experiment Station, was the first to work out the life history of this insect in Georgia, and since we now understand it thoroughly there are means to which we can resort to prevent the borer from injuring the trees to any great extent. Since the eggs are laid on the trunk of the tree, it has been found that a great deal of good can be accomplished by wrapping the trunk before the eggs are deposited. The wrapping should be done with brown paper or newspaper, to a height of about eighteen inches, and should be fastened to the top with a small wire or stout twine to prevent the larvae from entering the paper from above. The wrapping paper should be put in place by August 1st, as it is intended to hinder the first born larvae from entering the trunks of the trees.

#### MOUNDING.

After the paper cover is in place, the soil should be immediately mounded about the base of the tree ten inches high, covering the lower part of the paper. When trees are treated in this way, larvae hatching high up on the trunk and main limbs, after dropping to the top of the mound, will be forced to reach the tree through the paper wrapping at a point ten inches above the level of the ground. Before they succeed in effecting an entrance, many will be devoured by their natural enemies, such as ants and birds. This will also prevent them from getting very far down into the ground, and they will thus be more easily seen and gotten out when we are ready to worm the trees.

## WORMING.

After wrapping and mounding have been attended to by August 1st, it might seem that the trees will be thoroughly protected, but for some reason this is not true. The larvae manage to get into the base of the tree in spite of every precaution that can be taken. All kinds of devices have been resorted to in order to keep them out, but in spite of all these they manage to effect an entrance. Consequently, worming should always follow wrapping and mounding. Worming should begin the last week in October, for it is known that nearly all the eggs are hatched by October 15th. By doing this we can destroy a great many of the young larvae before they have injured the trees. By this time the wrapping and the mound should be removed, and it is quite an easy matter to remove the young larvae, which can be seen on the surface of the bark feeding on tender spots and covered with a mass of gum mingled with excrement and borings. This gummy mass, together with the worm beneath, can be removed with a curved bill hook arrangement, bluntly pointed at one end and provided with a double edge which should not be sharp, but about like a dull table knife. The majority of young borers will be found on the tree trunks several inches above ground, and, being for the most part on the surface, they can be easily scraped off.

## DETERRENT WASHES.

The most satisfactory wash to apply after worming is a compound of lime-sulphur and gas-tar, which was first recommended by Prof. Wm. Scott. This is made as follows: Slake one bushel of lime with a small amount of warm water. While the lime is slaking, add ten pounds of sulphur previously stirred into a paste. To this mixture add one-half gallon of gas-tar and then dilute with water to about 50 gallons. This wash carries sufficient lime to form a good coating over the bark, while not being thick enough to flake off when dry, and will serve to kill many of the young which you fail to find when worming.

## THE CURCULIO.

The greatest damage done to the fruit is done by the curculio. The curculio, is a dark-brown beetle that looks like a dried bud when slaken from the trees. When it falls to the ground it has a habit of playing "possum," remaining for a time without motion, seemingly lifeless. The beetles vary in size, but average one-fifth of an inch in length. They are provided with wings with which they fly easily for a considerable distance.

## LIFE HISTORY.

The beetles pass the winter under protection of weeds, rubbish, etc., in the orchards under and around peach trees, and also in leaves

and brush in the edge of forests which adjoin peach orchards. In the spring, when peach trees are just pushing out the tender buds, the curculios emerge from their winter quarters and commence to attack the young peaches. Mating soon takes place, and by the time the first fruit is set the females are ready to deposit eggs. The eggs are deposited by the female on the peaches, but, before depositing the eggs, she makes a small, crescent-shaped incision which she always employs to force the egg under the skin. Only one egg is deposited in a place, and as a rule only one to a peach; but if the fruit is very scarce, several eggs may be found on a single peach. The eggs thus deposited soon hatch into small, white grubs, which immediately bore toward the center of the fruit. Much of the infested fruit drops when quite small, but many of the peaches are not stung until the fruit is something like half grown, or larger, and in this case the fruit is forced to ripen prematurely.

In fallen, wormy fruit the grubs complete their growth, leave the fruit, enter the ground and transform into pupae. In about three or four weeks the pupae change into adults. There are about two broods a year in Georgia. The egg laying period of a single female may extend over eighty days. This accounts for the fact that small worms are found in nearly mature peaches.

#### REMEDIAL MEASURES.

Jarring the trees in the early spring for collecting the adult beetles was for a long time the only thing practiced by growers in trying to control curculio. Recent experiments show that jarring does very little good. In our experiments this year jarring, while partially successful, was not found to be practicable except on a very small scale. After the summer is advanced and the early mornings are warm, jarring is of no value. At the beginning of the season, when the trees are blooming, it is possible to catch great numbers of the beetles, and in this way reduce the percentage of wormy fruit.

#### ARSENATE OF LEAD.

Experiments for the control of curculio are conducted this year at Bagley and Woodbury, Ga. The method used was the same as that employed in 1906 and 1907, viz.: spraying with arsenate of lead.

Arsenate of lead was used at a strength of two pounds to fifty gallons of water. To this mixture was added a milk of lime solution made from three pounds of fresh stone lime; this solution being intended to reduce the tendency of the free arsenic of the compound to burn the foliage and fruit. Three plats of about 300 trees each were sprayed at this strength; the plats receiving one, two, and three applications respectively. Another plat was sprayed three times, at three pounds to fifty gallons of water, without the addition of the lime water.

Briefly, it may be stated that arsenate of lead was again successful, to a great degree, in controlling curculio. Owing to the weakened condition of the sprayed trees, some damage resulted to the fruit, most of which took the form of sun sca'd. The general effect of the treatments was materially to reduce the number of curculio larvae in infested fruit, and to give it color and quality.

Spraying with arsenate of lead at two pounds to fifty gallons is recommended. When trees are not vigorous and healthy, it is better not to spray more than twice. When trees are very vigorous and the foliage is dense, three applications give more satisfactory results.

To sum up, we recommend spraying with arsenate of lead, clean cultivation, and gathering of fallen fruit in order to destroy the larvae before they get into the ground to pupate.

Mr. FLEMING: What orchard were those experiments made on?

Prof. LEWIS: They were made at Fruit Haven Farm.

Prof. McHATTON: I would like to ask Prof. Lewis how much foliage can a tree afford to lose, and not be injured as to fruit and leaf buds for the succeeding year?

Prof. LEWIS: I think from 20 to 25 per cent. may be dropped without any apparent injury.

Prof. McHATTON: I believe they can afford to drop a little more than that. The trees at the Georgia Experiment Station were sprayed and about one-third of the foliage fell, and we had an excellent crop of fruit. I should like to know if anybody else has had any experience along that line?

The PRESIDENT: I now introduce to you Prof. J. S. Carroll, who will read you a paper on "Translocation of Plant Food Constituents."

## TRANSLOCATION OF PLANT FOOD CONSTITUENTS IN THE PLANT AND THEIR FUNCTIONS IN DE- VELOPING AND MAINTAINING GROWTH.

By Prof. J. S. Carroll, Atlanta, Ga.

Once upon a time, it is related that a priest was called upon by his parishioners to pray over their lands and bless them, in order that they might yield abundant crops. As he passed from place to place, pronouncing his benedictions upon the soil, he came upon a very unpromising field. Surveying these barren acres with great despair, he exclaimed: "Ah brethren, no use to pray here; this land needs manure."

From the writings of the earliest investigators we find that it was the custom of man to assist Nature in yielding abundant harvests by applying to the soil various substances called manures. Little did he know or understand at that time the fundamental principles underlying their use, for little work of any consequence had been undertaken to pry into Nature's secrets, or to attempt to interpret her immutable laws. As the years moved onward, man became more interested in the processes of Nature, and many learned investigators devoted years to the study of plant growth, the composition of plants, their food and sources of food supply, thereby laying the foundation and paving the way for our present knowledge of chemistry in its relation to agriculture.

While the beginning of true scientific agricultural chemistry may be dated from the important discoveries during the latter part of the eighteenth century by such scientists as Priestly, Scheele, Lavoisier, Cavendish and Black, yet it is interesting to pause a little while to note a few theories advanced by some of the early writers as to plant growth.

It was believed by the alchemists that manure acted in some mysterious way: that "spirits" left the decaying manure and entered the plants, producing a more vigorous growth. The worthless character of leached manure was attributed to the fact that the "spirits" had departed from such manure. From this source we have handed down to us such expressions as "spirits of hartshorn," "spirits of nitre," and many others, showing the ideas then entertained as to the composition of matter.

Early in the seventeenth century, Van Helmont undertook to solve the problem of plant growth, and proved to his satisfaction that all the products of plant growth were derived from water.

Some fifty years later Digby (1660) attributed the growth of plants to a kind of "balsam" which the air contained.

A theory advanced later by Jethro Tull was to the effect that the food of plants consisted of soil particles, and that these soil particles

must be rendered very minute before they could be absorbed by the rootlets. This theory is of interest since the importance of good tillage is emphasized in crop production.

The first contribution of importance to the subject of plant nutrition was made by a Swiss naturalist, Bonnet, during the eighteenth century. He found that air is the true source of carbon, which forms so large a part of the plant substance.

The first work written in the English language on agricultural chemistry was in 1795 by a Scottish nobleman, the Earl of Dundonald. His teachings were that plants "are composed of gases with a small proportion of calcareous matter."

DeSaussure, in 1804, gave to the world the most important contribution to science up to this time. He was the first to call attention to the mineral or ash constituents of plants, and maintained that these ash ingredients were essential, for without them plant life was impossible.

In the early part of the last century, Sir Humphrey Davy published a series of lectures on agricultural chemistry which added to the knowledge of the composition and function of the soil.

Boussingault, in 1838, was the first chemist to carry out elaborate experiments to determine the question whether plants could assimilate the free nitrogen of the air.

It was not until 1840, when Liebig published his celebrated work, "Organic Chemistry in its Application to Agriculture and Physiology," that the new science of agriculture was inaugurated. In his preface, he states that "perfect agriculture is the true foundation of all trade and industry, but a rational system of agriculture cannot be formed without the application of scientific principles, for such a system must be based on an exact acquaintance with the means of nutrition of vegetables and with the influence of soils and actions of manures upon them. This knowledge we must seek from chemistry which teaches the mode of investigating the composition and of studying the character of the different substances from which plants derive nourishment."

Chemistry tells us that the materials of which all matter is composed consists of some seventy distinct elementary forms of matter known as chemical elements. It is by means of chemical analysis that we are able to determine the elementary composition of the earth and its life.

Less than one hundred years ago it was learned that plants are built up from materials from the air and soil, water being one of them. The number and kind of elements that have been found to be absolutely essential to the growth of plants are ten: carbon, oxygen, hydrogen, nitrogen, phosphorus, potassium, calcium, magnesium, sulphur and iron. These are called plant food elements, and all healthy plants must contain them; and in the absence of one of them the plant cannot make a normal growth.

Plants derive their food from the air and the soil. The air supplies direct chiefly the element carbon, although it is the original source of hydrogen, oxygen and nitrogen. Hydrogen and oxygen are supplied mainly through the soil in the form of water.

About 95 per cent. of the total dry matter of plants comes from the air; the remaining 5 per cent. is the incombustible or ash constituents which are supplied exclusively by the soil. These ash constituents are indispensable, for without them the carbon of the air, the hydrogen and oxygen of the water, and the nitrogen of the soil and air could not enter into plant life.

The plant takes its food through the leaves and roots, which are called the organs of nutrition.

The chlorophyll or green coloring in the leaf-cell plays an important part, for it is in these leaf cells that the carbonic acid of the air is decomposed through the influence of light and heat, the carbon being retained while the oxygen is given off. This process is called assimilation, and takes place during the daytime, while at night the food made during the day is changed whereby it can be transferred in solution wherever it is needed. Iron as well as daylight is necessary in the formation of chlorophyll. The carbon absorbed by the plant and the hydrogen and oxygen taken up by the roots in the form of water meet in the leaves of the plant and are formed into starch, sugar, fat, etc., and the same elements, together with nitrogen and a little sulphur, form the albuminoids.

The manner in which the roots take up food is very different from that of the leaves, for the surface membranes of the roots are not full of holes, and solid matter cannot pass through. Therefore, the food must be in solution, and its absorption by the rootlets is obtained by means of diffusion or "osmosis." The food derived from the soil is not taken up as individual chemical elements, but chiefly in the form of acids or salts. Thus, nitrogen is combined with oxygen to form nitric acid, and when united with bases like potassium or calcium forms potassium nitrate or calcium nitrate. These weak solutions taken up by the roots are concentrated in the upper part of the plant owing to rapid evaporation by the leaves, and are used in the formation of new tissue.

While considerable research has been given the work of determining the functions performed by the different constituents taken into the plant, yet there is very little definite knowledge on this subject at the present time.

As the material furnished by the air is supplied freely and abundantly to every plant, it will not be necessary to devote any time to it, but we will turn our attention to the substances furnished by the soil. The soil does not always supply the plant with sufficient material for its growth, and as these deficiencies must be made good by

man before he can hope for abundant harvests, we will consider for a few moments the part they play in plant life.

Of the elements supplied by the soil as plant food, magnesium, iron and sulphur, and sometimes calcium, are usually found to exist in sufficient quantities to supply the requirements of plants. Potassium, phosphorus and nitrogen, and sometimes calcium, are not always present in sufficient amounts in an available form to supply the needs of the growing plants.

Sulphur occurs in plant tissue in comparatively small amounts. It is taken into plants in the form of sulphates, as potassium sulphate, calcium sulphate, and other sulphates, and plays a very important part in the formation of albuminous matter of plants. These albuminoids move about in the plant, principally toward the grain and fruit. In some plants sulphur is a constituent of the essential oils, and can be detected by the odor, such as in the onion, garlic, horseradish and others.

While iron is necessary for plant growth and is always present in plants, it occurs in about the smallest amount of any of the ash elements. The function of iron is to assist in the formation of chlorophyll, or the green coloring matter of plants. It is not known yet whether iron enters into the chemical composition of chlorophyll, or is merely associated with it.

Magnesium occurs in much smaller amounts than calcium does, although it is stored up in the seeds about three times more liberally than is calcium. Magnesium assimilates more slowly than any of the other ash constituents of plants. It enters into the chemical composition of the chlorophyll, although plants do not require much magnesium until the period of formation of the seeds. It has been found that plants grown with an incomplete supply of magnesium frequently have sterile seed.

Calcium is always present in the ash material, and plants cannot reach full maturity without it. In fact, some crops, such as clover, peas, alfalfa, require so much calcium that they are called "lime plants." The special function of calcium is in assisting in the construction of the cell walls, and no new plant cells can be formed without it. Calcium is found in the leaves of plants at all stages of growth, and is very necessary for their full development. It has been stated that calcium compounds are necessary for the conversion of starch into cellulose.

When the growth of a plant has been checked by withholding calcium, the plant will show increased vigor within a few hours after supplying it. Calcium, unlike magnesium, is assimilated in the early stages of the plant's growth; for example, in wheat 80 per cent. is assimilated before the plant heads. It does not accumulate to such an extent in the seeds as do some of the other ash elements, for only

about 1/10 of the amount removed by grain crops is in the seeds, the remaining 9/10 being distributed throughout the straw.

It is probable that more work has been devoted to the study of nitrogen as a food for plants than to any other element. This is a specially interesting subject for the reason that plants are surrounded by an atmosphere of nitrogen, and it was to determine whether it was possible for plants to use the nitrogen direct from the air. It has been found that there are only certain plants called "legumes" that have the power of utilizing this nitrogen for food by means of nodules or tubercles on their roots. Nitrogen is taken up by the roots of plants in the form of nitrates and combines with carbon, hydrogen, and other elements, to form the nitrogenous compounds so largely present in plants. In the absence of nitrogen, a plant makes no appreciable growth, and when there is an insufficient supply of this element the plant's foliage does not develop a rich green color, but takes on a yellowish tinge.

Phosphorus occurs in parts of the plant in the form of phosphates. These phosphates play a very important part in the development of the young plant at the time of germination.

Phosphoric acid is one of the constituents of chlorophyll, and is necessary for the building up of every plant cell. It is not only important to young plants, but is necessary at all stages of the plant's growth.

The chief function of phosphorus may be said to be aid in the production and transportation of the proteid substances. These proteid bodies which are produced in the leaves are finally transported to the seed, where they accumulate to the greatest extent. From 60 to 75 per cent. of the total phosphates removed in a crop is found in the seeds.

The translocation of phosphoric acid in the plant is very interesting. It is the most mobile substance of all the inorganic constituents of plants. It is continually moving from the lower to the upper part of plants, and a large percentage of phosphoric acid found in the grain was moved from the leaves and stems of plants even after it had once come to a rest in these organs.

In speaking of the function of potassium, Professor Snyder, in his excellent work on "The Chemistry of Plant and Animal Life," says: "Potassium is one of the most important and least variable of all the elements found in the ash plants. It is quite evenly distributed throughout the growing plant, and generally occurs in the entire plant in the largest proportion of any of the essential ash elements. It is taken up in the early stages of plant growth and is always present to the greatest extent in the active and growing parts as in the leaves where the production of plant tissue occurs. Potassium is one of the elements most essential for the plant's development."

"The function of potassium is apparently to aid in the production and transportation of the carbohydrate compounds, as starch and sugar, and thus indirectly in the formation of all organic matter. In sugar and starch-producing crops, as sugar beets and potatoes, it takes an important part in the growth and development. Potassium doubtless has much to do in the way of regulating the acidity of the sap by forming organic salts, such as potassium bitartrate in grapes. At the time of seed formation there is a slight retrograde movement of the potash, in some cases a small part being returned to the soil. The supply of available potash in the soil has great influence upon the vigor of plant growth. Weak and sickly plants are always deficient in potash. Some crops require more for growth than do others, and some experience difficulty in obtaining it. Some plants contain such large amounts of potash that they are called 'potash plants.'"

All research shows that in the higher order of plants potassium cannot be replaced or substituted by any other element.

It is a common fact to all plants that the various constituents move about in the plant during its growth.

The leaf of the plant is its laboratory where food is prepared for the support of the parts of the plant. But when the leaf has grown old and the purpose of its existence has been performed, it gives up its life and substance to perfect the new part of the plant and finally to the perfection of the seed whereby the plant may perpetuate itself.

It is known that plants do not have the same chemical composition at different stages of growth, and it is due to the discovery of this scientific principle that we have been taught some highly important lessons as to the times and seasons at which crops may best be harvested.

There is yet much work to be done in adding to our present knowledge of the special functions of different plant food constituents, and no field of research offers better opportunity to our scientists than the investigations of this character.

The PRESIDENT: Gentlemen, this ends the program of essays that we have before us. Now, we have half an hour before dinner and, as a great many of the members wish to leave at 2:30, we will have to conclude our work within that time. We will now hear the reports of committees, then comes the election of officers, the selection of the next place of meeting, then the resolutions, and the question box. The time of meeting has been changed to the fourth Wednesday in January, 1910,

which is the 26th of January. I think the next thing to be determined is, where shall we meet? What is your pleasure on that subject, gentlemen?

Mr. ROGERS: I respectfully invite you to meet next year with us at the Agricultural College near Sparta, Ga.

Mr. MORRILL: I wish to invite the Society to meet at Macon next year. It is the most centrally located city in the State; it has railroads entering it from every point of the State; it is the Hub of the State, and I would like to have you meet there, at the Auditorium.

The PRESIDENT: I do not wish to say anything detrimental of Macon, but the last two sessions we had there our attendance was very small.

Mr. WADE: I move that the invitation from Sparta be accepted.

The motion was duly seconded and carried.

The PRESIDENT: The next business in order is the election of a President, Secretary and Treasurer for the ensuing year.

Prof. McHATTON: I move that the present officers be re-elected for the next year.

The motion was duly seconded and the present officers were declared re-elected for another year, to-wit: P. J. Berckmans, President; J. B. Wight, Secretary; L. A. Berckmans, Treasurer.

The PRESIDENT: I have been trying for thirty-three years to get out of harness, but it seems you won't let me. I am willing to do the best I can for the success

of the organization, but I will only undertake to serve you upon condition that we have more enthusiasm and more interest taken in the welfare of the Society; and, unless we can get a larger attendance at the next meeting and show that our work is appreciated, then I won't promise you to do as much as I have done heretofore. I think you owe that to yourselves, that you keep up this organization with greater zeal than you have manifested lately. I thank you very kindly and, as I have said, I will serve you to the best of my ability on those conditions. The next thing in order, gentlemen, is to fill some vacancies among our Vice-Presidents.

Mr. WIGHT: I move that the President be authorized to fill all these vacancies as he may see fit.

The motion was duly seconded and carried, and the President authorized to fill the vacancies now existing.

The PRESIDENT: We will now hear the report of the Committee on Resolutions, by Mr. B. W. Hunt, Chairman.

Mr. HUNT: The Committee on Resolutions desires to report as follows:

1st. We wish to express the appreciation of all members of this Association to the presiding officer for his tactful and kindly service, not only on this occasion, but for the past thirty-three years, which has been unselfishly given to the advancement of horticulture among us.

2nd. We desire to thank the Southern Express Company for courtesies.

3rd. We wish to return to the proprietors of the palatial Georgian Hotel our thanks for the use of the auditorium during our meetings.

4th. The citizens of Athens make us debtors to them for the bountiful barbecue and the pleasant excursion through their historical city of beautiful residences.

5th. To the press of Georgia for free publication and announcement of our annual session, we are truly grateful.

6th. We thank the Southern Railway Company for the presence of their representatives.

7th. We extend our appreciative thanks to the Hon. James Wilson, Secretary of Agriculture, for having requested the presence at our annual meeting of Col. G. B. Brackett, Chief Pomologist of the United States Department of Agriculture.

8th. To President Soule of the State Agricultural College and members of its faculty, we extend our thanks for their valuable aid in making our session successful.

Our Secretary is requested to send by mail a copy of these resolutions to interested parties.

B. W. HUNT,  
B. VonHERF,  
H. E. WAERNICKE,  
Committee.

Col. WADE: As I believe the question box is now open, there are two questions which I wish to ask. In the first place, the question of the shipment of diseased trees into the State is one of serious moment. I think the matter ought to be taken before the Legislature, and make it a crime for any nurseryman to ship diseased trees of any kind into this State. It is a question that has been discussed many times, but no action has ever been taken.

My second question relates to the pear or leaf blight. I find it impossible to exterminate this dreadful scourge except by cutting out the limb, or the entire tree. I have never been able to find anything that would control it, but I have a letter from California stating that it can be cured. If any of our Experiment Station people here can tell us anything about it, I should like to hear from them.

Prof. McHATTON: I was going to ask a question about pear blight myself. The Agricultural Department

at Washington has a remedy which they offered to furnish me if I would give the result of my experiments to the world; I have tried it for a year, but where I put it on according to directions it didn't have any effect at all, and where I put on enough to kill the bacteria it also killed the tree. We had a long correspondence on the subject, and nearly came to blows through the mail, so to speak.

Col. WADE: I would like to ask if there is any way to stop crown gall, and to know whether, if one tree is affected with it, it will give the disease to the next tree, or the entire orchard?

Mr. LEWIS: I don't think there is any danger of transmitting the disease by coming in contact with it. The experiments seem to indicate that it is not very contagious; there are two forms of the disease, however, and one is much more contagious than the other.

Col. WADE: In one instance that I know of, it destroyed an entire orchard.

Mr. LEWIS: It has been found that it can be prevented by using rubber bands around the trees.

Prof. McHATTON: I wish to make a motion that the President at his leisure appoint a Committee to draw up some resolutions on the death of Capt. R. E. Park, who was one of the Vice-Presidents of our Society; and that a copy of these resolutions be sent to the family of Capt. Park, and that they also be spread upon the minutes of the Georgia State Horticultural Society.

Col. FORT: Capt. Park having been a personal friend of mine, I request that I be included in that Committee:

The PRESIDENT: I will appoint you Chairman of the Committee, and you may choose your own co-ordinates.

Mr. WIGHT: There are a great many plants that have been originated or introduced into Georgia by a certain party, and Georgia horticulture owes more to that party in this respect than to probably every other person in the State. It is not necessary to name the person to whom I refer, and I should like to make a motion that President Berckmans be requested to prepare a paper for the next meeting of the State Horticultural Society, giving an account of all these introductions.

The motion was duly seconded and carried.

Mr. HUNT: I think it is eminently fit and proper that we should work Mr. Berckmans for his own benefit, as well as for our own. He has been giving his life and his services to us with very little hope of reward, and what goes down in permanent form over his signature will be accepted as authority in years to come. But we also prize it. That is the field in which he can do the best work. We would not have known Darwin if he had not left us his works. If Dr. Berckmans takes up half the catalogue, so much the better. Among the plants which he has originated are the three biotas which I referred to. I went through Bailey's Cyclopædia of Plants, and there is practically nothing on the subject of biotas, just a few lines. That is a point Mr. Berckmans should

cover, and also his introduction from Japan of that Citrus Trifoliata and what it has done for the citrange; and many other plants that I can not enumerate. If a citizen of New York had done half the originating that Mr. Berckmans has done, the nurserymen and the press would publish his fame abroad; but the people down here don't know him. I want him in this paper to turn himself loose, and tell how he did it and why he did it, so that the people who come after him may imitate him.

Col. WADE: I wish also to insist on this motion. I think we ought to appreciate our President while he is still with us, and not wait until he is dead to cover his grave with flowers.

Mr. MORRILL: I will have to differ with my brother, Col. Hunt. I have always been under the impression that Mr. Berckmans had a world-wide reputation, not only in the South and the United States, but the whole world. I heard of him before I ever came South, in the West and in the East. You can not confine Dr. Berckmans to the State of Georgia; the world knows him, and I will have to differ with my brother on that line.

Col. WADE: I want to ask Mr. Fleming a question about our Fruit Exchange: Where did you get this information, that 2,000 cars this year netted about the same as 6,000 cars last year?

Mr. FLEMING: I wasn't accurately quoted on that point. There was no information at hand as to what this crop last year netted, and certainly there could be no information as to what the crop this year netted. The papers have no doubt drawn more or less on their im-

agination, but we have pretty good ideas in a general way as to results.

Col. WADE: Have you any estimate as to what the average car sold for this year?

Mr. FLEMING: It would be a matter of guess work for me to estimate it.

Col. WADE: It seems to me that these figures have been over-rated. The result is that, while the Exchange will help central and southern Georgia and we want to see the organization succeed, we don't want it to succeed by hitting somebody else. Is it not a fact that it was on account of the short crop that you had so many cash buyers this year?

Mr. FLEMING: No, sir, I don't think so. The short crop played but a small part in the f. o. b. proposition. As I understand it, the movement from your territory was made up entirely of miscellaneous shippers, and you can not expect cash buyers to come into a territory where there were no solid cars loaded.

Col. WADE: There were three cars loaded there; our normal condition is about 500 cars.

Col. FORT: I move that we adjourn until January 26th.

The PRESIDENT. I thank you, gentlemen, for the attention you have shown in these deliberations, and also for your kindnesses to me; and now, when we adjourn until January 26th, I hope you will not come to that meeting with only a corporal's guard, as you did this time, but with a brigade. I now pronounce this session ended.

### **CAPT. R. E. PARK.**

Mr. J. P. Fort, at his own request, was appointed by the chair to prepare memorial resolutions relative to the death of Capt. R. E. Park. Mr. Fort brought forward the following resolutions and the same, on being approved, were placed upon the minutes of the Society:

This Society, as well as the State of Georgia, suffered a great loss in the death of Capt. Park.

I knew him personally for nearly half a century. A man of great probity of character, of unswerving integrity, and strong intellect.

He illustrated our State upon the field of battle.

In all the relations of life as husband and father his character shone forth as a true Southern gentleman.

Our eyes are suffused with tears when we bid farewell to this intrepid soldier and honest man.

He served the Georgia State Horticultural Society as Vice-President for the Seventh Congressional District during many years, where his wise counsel and good work in its progress were always freely given. His associates, who miss his companionship, hereby dedicate this page in our proceedings to the memory of one who was an earnest co-worker in our cause.

# CATALOGUE OF FRUITS.

## PLAN OF CATALOGUE.

To enable the Society to publish a full and reliable catalogue of fruits which are successfully cultivated in Georgia, and in view of the vast differences which the climatic influence of the several sections of our State has upon the same fruit cultivated upon the mountains or near the seacoast, it has been deemed advisable to divide the State into four distinct sections.

1. The *Upper or Mountainous Region*, comprising the counties of Banks, Bartow, Catoosa, Chattooga, Cherokee, Cobb, Dade, Dawson, Fannin, Floyd, Forsyth, Franklin, Gilmer, Gordon, Habersham, Hall, Haralson, Lumpkin, Milton, Murray, Paulding, Pickens, Polk, Rabun, Stephens, Towns, Union, Walker, White and Whitfield.

2. The *Middle Region*, comprising all of the counties of the State not included by name in the other three regions.

3. The *Southern Region*, comprising the counties of Appling, Baker, Ben Hill, Berrien, Brooks, Calhoun, Charlton, Clinch, Coffee, Colquitt, Dougherty, Early, Echols, Grady, Irwin, Jeff Davis, Lowndes, Miller, Mitchell, Pierce, Thomas, Tift, Turner, Ware, Wayne and Worth.

4. The *Lower or Coast Region*, comprising the counties of Chatham, Bryan, Liberty, McIntosh, Glynn and Camden.

The explanations of the columns will be found under each class of fruits.

The varieties named in the several lists are of recognized good quality, inferior or rejected varieties being omitted.

Synonyms are given in a few instances only where it was deemed necessary; these are placed after the adopted name.

One "\*" indicates that the varieties succeed well in the region named at the head of column. Two "\*\*\*" indicate the varieties most highly recommended. No "\*" indicates no report, or that the variety is not sufficiently tested. A dash "-" indicates that the variety is unsuited.

## EXPLANATION OF TABLE.

### EXPLANATION OF COLUMNS—

Column 1—Name of varieties.

Column 2—Season of maturity.

Column 3—The particular use for which it is best adapted.

Columns 4, 5, 6 and 7—The regions for which the varieties are recommended.

Column 8—Remarks.

# APPLES.

## EXPLANATION OF ABBREVIATIONS—

Column 2—*Seasons*—S, summer; A, autumn; W, winter, E, early; L, late; E. S., early summer; L. W., late winter, etc.

Column 3—*Use*—K, designates varieties recommended only for the kitchen or cooking purposes; D, for drying; C, for those specially intended for cider; M, those most valued for market. Varieties not marked may be considered as table or dessert sorts.

NAME.	Season	Use	Rating.				REMARKS.
			Mountain Region	Middle Region	Southern Region	Coast Region	
Astrachan Red	ES	M	**	**	*	*	Profitable early market; very prolific.
Arkansas Black	W	M	*	*	*	*	Late keeper.
Ben Davis, (syn., New York Pippin)	LW	M	**	*	*	*	Second quality, excellent keeper.
Black Warrior	LW	M	**	*	*	*	Excellent; fine keeper; prolific.
Bonum	A	M	*	*	*	*	An excellent late fall apple.
Buncombe (syns., Meigs' Red Winter Pearmain, Red Fall Pippin)	A	M	***	*	*	*	Excellent; in some soils liable to blight of bloom buds.
Carolina Greening (syns., Green Crank, Southern Greening, Green Cheese)	W	M	**	*	*	*	Excellent.
Carolina Watson	S	M	*	*	*	*	Very large; prolific; profitable market.
Carter's Blue (syn., Lady Fitzpatrick)	A	M	*	*	*	*	Large, sugary, very fine; splendid grower.
Cates	A	M	*	*	*	*	Profitable fall apple.
Chattahoochee	W	M	**	*	*	*	Excellent and fine keeper.
Coffman	E	M	*	*	*	*	An improved Red June.
Cullasaga	EW	*	*	*	*	*	Requires strong clay soil.
Disharoon	A	M	*	*	*	*	Good quality; fine grower.
Early Harvest	ES	M	**	*	*	*	Universal favorite.
Elgin Pippin	A	M	*	*	*	*	Large and very good.
Equinetelee (syns., Bachelor, Buckingham)	A	M	**	*	*	*	Very good; needs strong soil; subject to borers.
Etowah (syn. Cooper's Red)	W	M	**	*	*	*	Very good; fine keeper.
Fall Pippin	A	M	*	*	*	*	Large and very good.
Family	S	M	***	*	*	*	Excellent and profitable summer apple; prolific. (life.)
Gravenstein	ES	K	***	*	*	*	Productive; a valuable summer variety.
Grimes' Golden	EW	M	**	*	*	*	Very good in Mountain Region.
Hargrove	A	M	*	*	*	*	Good quality and market sort.
Hiley's Eureka	LW	M	***	*	*	*	Late keeper.
Hockett's Sweet	LW	M	**	*	*	*	Prolific and good keeper.
Hominy (syns., Summer Queen of Kentucky, Sops of Wine)	S	M	***	*	*	*	Excellent; prolific.
Horn	LW	*	*	*	*	*	Good keeper; open grower. (two months.)
Horse	S	K	***	*	*	*	Superior for cooking and drying; prolific; lasts
Jewett's Best	S	*	*	*	*	*	Very large; very good; stout grower.
Julian	S	K	***	*	*	*	Productive; excellent for cider; showy fruit.
Kansas Queen	S	M	***	*	*	*	Very showy; reliable bearer.
Kentucky Red Streak. (syn., Bradford's Best)	A	H	*	*	*	*	Fine grower.
Kinnard	W	M	**	*	*	*	Excellent for Mountain Region.
Lenier	A	M	*	*	*	*	Showy fall apple; good quality.
Mangum	W	M	***	*	*	*	Excellent; prolific, subject to codling moth.
Maverick's Sweet	W	M	***	*	*	*	Very good; good keeper. (Region.)
May Pippin	ES	*	*	*	*	*	Very early; reliable in Middle and Mountain
Mitchell's Cider	S	C	**	*	*	*	Promising well; late summer.

# APPLES.—Continued.

NAME	Season	Use	Rating.				REMARKS.
			Mountain Region	Middle Region	Southern Region	Coast Region	
Moultrie, (syn., Indian Winter)	LW	M	****				Good and late keeper.
Mrs. Bryan	A	M	****				Showy and excellent; valuable for market.
Nickajack (syns, Summerour, Berry, Wonder)	W	M	*				Excellent in some sections of Middle Region; unreliable; apt to drop before attaining full size.
Oconee Greening	A	K	*	*			Excellent.
Ossi-vej	ES		*	*			Showy and prolific; from Hungary.
Palmer, (syn., Pear)			*	*			Medium; very good; prolific.
Paragon	W	M	*	*			Good keeper.
Pinestump	A	M	*	*			Promising for Piedmont area.
Red Beltgaimer	A	K	*	*			Promising well.
Red June, (syn., Carolina Red June)	ES	M	*****				* Early, prolific, very good; bears very young; profitable for market.
Rhodes' Orange	ES		*	*			Excellent summer fruit.
Rome Beauty	A	M	****				Showy and excellent.
Romanite	LW	M	***	*			Good quality; excellent in Mountain Region.
Rough and Ready	W	M	*	*			Profitable in Northwest Georgia.
Royal Limbertwig	W	M	*	*			Good for Mountain Region.
Sauta	LW	M	*	*			* Very good; late keeper, even on coast.
Shockley	LW	M	****	*			* Reliable in every section; profitable.
Simmons' Red	S	K	*	*			* Matures fruit from June to October.
Stephenson's Winter	LW	M	****	*			Unsurpassed in quality, bearing and keeping.
Striped June, (syn., Early Red Margaret of the South)	ES	M	****	*			* Excellent; fine grower and prolific. (ing.
Summer Cheese	S	K	***	*			* Large, prolific; excellent for cooking and dry-
Summer Queen	S	M	***	*			* Good market apple.
Sweet Bough, (syn, Sweet Harvest)	S	M	****	*			* Very good; early; sweet. (open grower.
Taunton	A		***	*			Large, showy; good quality; fine for market;
Terry	LW	M	***	*			An excellent keeper; good quality; profitable
Tetofski	ES		*	*			Promising; tree very dwarf.
Wade, (syn., Poor House)	W	M	**	*			Excellent winter apple of pippin type.
Wallace Howard	A	M	*	*			Very showy; excellent.
White Winter Pearmain	W		***	*			* Good.
Winesap	LW	M	****	*			Quality very good.
Winter Queen, (syn., Poor House Winter Gem)	W	M	****	*			Reliable bearer; valuable and late keeper.
Yates	LW		****	*			Very good quality; small.
Yellow Transparent	ES	M	****	*			Showy and early.
Yopp's Favorite	S	K	*	*			Very good; prolific; bears young; desirable.
York Imperial	W	M	*	*			

## CRAB APPLES.

NAME	Season	Use	Rating.		REMARKS
			Mountain Region	Middle Region	
Golden Beauty	A	C	*	*	
Red Siberian	LS	C	*	*	
Transcendant	LS	C	*	*	* Largest and most showy.
Yellow Siberian	LS	C	*	*	

# APPLES.—Continued.

## LEADING VARIETIES OF APPLES FOR MARKET ORCHARDS.

SUMMER—Astrachan, Early Harvest, Gravenstein, Hominy, Horse, Kansas Queen, Red June, Yellow Transparent.

AUTUMN—Buncombe, Equinetelee, Fall Pippin, Hargrove, Bonum, Mrs. Bryan, Rome Beauty, Striped June, Wallace Howard.

WINTER—Arkansas Black, Black Warrior, Ben Davis, Grimes' Golden, Horn, Hockett's Sweet, Mangum, Romanite, Rough and Ready, Shockley, Stephenson's Winter, Terry, Yates, Winesap, Winter Queen, York Imperial.

## PEACHES.

EXPLANATION OF COLUMNS.—1st, name of variety; 2d, class—freestone or clingstone; 3d, color of flesh; 4th, season; 5th, use. Remainin columns denote the region. etc.

ABBREVIATIONS.—Class—F, freestone; C, clingstone; S. C., semi-cling Flesh—W, white; Y, yellow; R, red. Season—E, early; VE, very early; M, medium; L, late; VL, very late. Very early, ripens from end of May to June 20th; early, from August 10th to October 1st; very late, from October 1st to November 10th. Use—F, for family use only; M, the most valuable for market; D, the most desirable for drying.

NAME.	Class	Color of Flesh	Season	Use	Rating.			REMARKS.
					Mountain Region	Middle Region	Southern Region	
Albright's Oct.	C	W	VL	F	**	*		A very good late variety.
Alexander, (syn., Amsden)	SC	W	VE	M	**	*		* Quality good, for its season; bright color; still profitable in some sections.
Amelia, (syn., Stroman's Carolina)	F	W	E	F	**	*		* Very large; very good.
Baldwin's Late	F	W	VL	F	**	*		Good late freestone.
Belle	F	W	M	M	****	*		Of Chinese type; earlier than Elberta
Berenice	F	Y	L	MF	****	*		* Large, showy, excellent.
Brandywine	F	Y	M	M	*			For home market.
Bustian's October	C	W	VL	M	**	*		An excellent very late cling.
Carman	F	W	VE	M	****	*		* Superior to Waddell.
Chair's Choice	F	Y	M	F	*			Good freestone.
Champion	F	W	M	MF	**	*		Of excellent quality.
Chinese Cling	C	W	M	F	*	*		* Excellent and large; subject to rot.
Chinese Free	F	W	M	M	*	*		Somewhat earlier than Thurber.
Columbia, (syns., Indian, Face)	F	Y	M	MD	**	*		* Excellent for all purposes
Cora	F	W	VL	F	*	*		Superior to Baldwin.
Cornelia	F	W	M	MF	*	*		Precedes Belle; promising.
Crawford's Early	F	Y	E	F	*	*		Good, but small.
Crawford's Late	F	Y	M	F	*	*		Variable; rots in some seasons.
Darby	C	W	VL	F	****	*		An excellent October cling.
Demming's September	C	Y	L	F	**	*		Similar to Lemon Cling; ripens one month later.
Doctor Berckmans	F	W	M	F	---	*		Excellent; of Chinese type.
Early Tillotson	F	W	E	M	****	*		* Very good; inferior to Hiley.

# PEACHES—Continued

NAME	Class	Color of Flesh	Season	Use	Rating			REMARKS.
					Mountain Region	Middle Region	Southern Region	
Eaton's Golden.....	C	Y L	F	** *				Superior cling for preserving.
Elberta.....	F	Y M	M	*****				Very large and handsome; standard market variety. (sections.)
Emma.....	F	Y M	M	** *				Follows Elberta; profitable in some
Everbearing.....	F	WEM	F	** *				Unique; good for family use. Bear two months.
Flewellen.....	C	R E	F	.. *				Good early cling of Indian type.
Fleitas St. John, (syn., May Beauty).....	F	Y E	M	** *				Very good; early, but small.
Ford.....	F	W E	M	** *				Large, early; promising.
Fox.....	F	Y M	F	** *				A late freestone.
Frances.....	F	Y M	F	** *				Very large and handsome. (see Cling)
General Lee, (syn., R. E. Lee).....	C	W M	M	*****				More reliable than its parent, Chin
General Taylor.....	C	R E	M	** *				Very good early cling.
Goode's October.....	C	R VL	F	** *				Very good late Indian cling.
Gordon.....	C	Y L	M	** *				Excellent late variety; good quality
Greensboro.....	F	W VE	M	*****				Quality very good; profitable market sort.
Heath White, (syn, White English).....	C	W L	F	** *				Excellent for preserving and home (market.)
Hiley, (syn., Early Belle).....	F	W E	M	** *				Improvement on Tillotson.
Indian Blood.....	C	R M	F	** *				Very juicy and good. (than oriole.)
Junio.....	C	Y L	F	** *				Excellent quality; three weeks later
Kennesaw.....	F	W VE	F	** *				Follows Carman; promising.
Kent, (syn., Dr. Hogg).....	C	Y L	F	** *				Large, good quality.
Lady Ingold.....	F	Y M	F	** *				Excellent; somewhat earlier than E Crawford.
Lemon Cling, (syn., Pine-apple).....	C	Y M	F	** *				Superior for preserving.
Mayflower.....	F	W VE	F	** *				Said to be the earliest of all.
Mamie Ross.....	F	W E	M	** *				Promising market variety.
Miss Lola.....	F	W E	F	** *				Promising.
Mountain Rose.....	F	W M	F	** *				Excellent quality.
Muscogee.....	F	W M	F	** *				White fleshed Columbia; good.
Newington Cling.....	C	W M	F	** *				Superior to Oldmixon cling.
Oldmixon Free.....	F	W M	F	** *				Good family variety.
Oldmixon Cling.....	C	W M	F	** *				Good family variety.
Oriole.....	C	Y M	F	** *				One of the best yellow July clings.
Oseola.....	F	Y L	F	** *				Good freestone of Indian type.
Pallas.....	F	W M	F	** *				Seedling of honey; better and reliable.
Pendleton.....	C	Y L	F	** *				Best freestone of its season.
Picquet's Late.....	F	Y L	FD	** *				Large, showy; August.
Plant.....	C	Y M	F	** *				Excellent market variety.
Red River.....	F	W VE	M	** *				Excellent quality; medium size; too tender for market.
Rivers.....	F	W VE	F	*****				Superior to Old Mixon Free; very reliable.
Robert.....	F	W M	M	** *				Follows Elberta as a shipper.
Salway.....	F	Y L	M	** *				Good late cling.
Scott's October.....	C	Y VL	F	** *				Promising for market.
Slappey.....	F	Y M	M	** *				A very early shipper; poor quality.
Sneed.....	SC	W VE	M	** *				Best very late market variety.
Stinson's October.....	C	W VL	M	** *				Not as valuable as formerly.
Stump the World.....	F	W M	M	** *				Large; superior to L. Crawford.
Susquehannah.....	F	Y M	F	** *				Late freestone; promising.
Texas.....	F	W L	M	** *				Large; excellent quality; profitable
Thurber.....	F	W M	M	** *				

# PEACHES—Continued.

NAME	Class	Color of Flesh	Season	Rating					REMARKS.
				Use	Mountain Region	Middle Region	Southern Region	Coast Region	
Tinsley's October.....	C	W	VL	F	***				Good late cling.
Tuskana.....	C	Y	E	F	***				* Similar to Lemon Cling; June. (ising
Victor.....	SC	W	VE	F	*	*	*		Very early; good quality; very prom-
Waddell.....	F	W	VE	M	**				Early and profitable; matures with
									Carman.
Wonderful.....	F	Y	L	F	*				Good late freestone.

## LEADING VARIETIES IN ORDER OF MATURITY FOR FAMILY USE OR HOME MARKET.

Mayflower, Victor, Sneed, Alexander, Greensboro, Red River, Ford, Carman, Waddell, Kennesaw, Mamie Ross, St. John, Hiley, Lady Ingold, Dr. Berckmans, Mountain Rose, Champion, Everbearing, Early Crawford, Pallas, General Lee, Chinese Free, Thurber, Oriole, Elberta, Chair's Choice, Berenice, Plant, Columbia, Robert, Lemon, Juno, Salway, Picquet, White Heath, Demmings, Pendleton, Eaton's Gold, Cora, Albright, Summerour, Stinson's October.

## LEADING VARIETIES FOR SHIPMENT TO NORTHERN AND WESTERN MARKETS.

Greensboro, Carman, Waddell, Mamie Ross, Hiley, Belle, Chinese Free, Thurber, Elberta, Robert, Salway.

## NECTARINES.

Boston, Coosa, Downton, Early Newington, Early Scarlet, Early Violet, Elruge, Golden Cling, Hardewick, Hunt's Tawny, New White, Red Roman, Stanwix, Victoria.

Reports from every section state this fruit to be unreliable, owing to attacks of the Curculio, and, unless carefully sprayed, is unproductive.

## APRICOTS.

Explanations and abbreviations same as Peaches.

# APRICOTS—Continued.

NAME.	Class	Color of Flesh	Season	Use	Mountain Region	Middle Region	Southern Region	Coast Region	REMARKS.
Breda.....	F	Y	F	---	*	*	---	---	Trees in orchards are liable to be killed by spring frost. Only desirable for city gardens or where protected by surrounding buildings.
Early Golden.....	F	Y	F	---	*	*	---	---	
Hemskirke.....	F	Y	M	---	---	---	---	---	
Kaisha.....	F	Y	M	---	---	---	---	---	
Large Early.....	F	Y	E	---	---	---	---	---	
Large Red.....	F	Y	M	---	---	*	---	---	
Moorpark.....	F	Y	L	---	---	---	---	---	
Orange.....	F	Y	M	---	---	---	---	---	
Peach.....	F	Y	M	---	---	*	---	---	
Royal.....	F	Y	M	---	---	*	---	---	
St. Ambrose.....	F	Y	M	---	---	---	---	---	
Turkey.....	F	Y	L	---	---	---	---	---	

# POMEGRANATES.

The Climate of Mountain Region is too cold to grow this Plant.

NAME.	Mountain Region	Middle Region	Southern Region	Coast Region	REMARKS.
Acid.....	---	*	***	---	Suitable for the Middle, Southern and Coast regions.
Sub Acid.....	---	*	***	---	
Large Sweet.....	---	*	***	---	
Spanish Rugsy, (syn., Purple seeded.).....	---	*	***	---	

# NUTS.

## WALNUTS.

ENGLISH:—*Juglans regia*—The most suitable soils are calcareous clay, loam, gravelly or stony, naturally well drained; stiff clays retentive of humidity, are unsuited.

Particularly in the Southern and Coast regions the English walnut does not live well on its own roots. The Black walnut is being experimented with as a stock on which to bud or graft the English walnut, and results so far are very promising.

ENGLISH OR COMMON—This is the typical variety, from which are derived the following forms of sub-varieties not profitable east of the Rocky Mountains.

*Chaberte*—Nut oval, medium, full kernel, rich in oil, blooms late.

*Early Bearing* (*Præparturiens*)—Nuts medium, nearly round, good quality. The tree is remarkably prolific and begins to yield fruit at from four to five years from seed. Half hard shell.

*Franquette*—Large, oblong, pointed, full kernel, half hard shell.

*Mayette*—Nuts produced in pairs, half hard shell, full kernel, excellent quality.

*Parisienne*—Large, oblong, half hard and rough shell, kernel scarcely filling the shell. Very prolific and of good quality.

*St. John*—Nuts medium, hard shell, good quality. Blooms latest of all, and valuable where late spring prevails.

*Thin Shelled*—Nuts large, oblong, very thin shell, of excellent quality and the standard dessert variety. Keeps sweet a long time. Its shell is likely to be crushed when roughly handled.

*Barthere*—Nut very long, half hard shell, full kernel.

*Ailantus Leaved*—Fruit produced in pendulous clusters, wholly of ornamental value.

*Cut Leaved*—Leaves deeply lacinated. Nuts medium, of good quality.

*Long Beaked*—Fruit with a long beak. Of no special commercial value.

WALNUT JAPAN: (1) *Juglans Sieboldiana*—A native of the mountains of Japan; extremely hardy and vigorous grower, with beautiful and symmetrical form. Nuts have been produced at three years of age. Wonderfully productive. On older trees the clusters consist of from 6 to 20 nuts. Shell thicker than that of the English Walnut. Meat sweet and of good quality.

(2) *Juglans cordiformis*—Differs from the preceding variety in the form of nut, which is broad pointed and flattened; of medium size, with thinner shell than *Sieboldiana*, and if cracked longitudinally the kernel may be removed entire. Meat of good quality. Tree very vigorous grower; attains great height with magnificent head. Probably the best of the cultivated walnuts for this section.

WALNUT, AMERICAN BLACK—(*Juglans nigra*)—Fruit large, very hard shell, kernel sweet. Doubtless susceptible of producing improved varieties by judicious selection. Timber value for cabinet work.

WALNUT, ASHY GREY OR BUTTER NUT—(*Juglans cinerea*)—Mountain districts, nut large, hard shell. May be improved under cultivation. The timber is valuable for cabinet work.

# PECANS.

(List Revised by J. B. Wight, Cairo, Ga.)

(*Hicora pecan.*)

Pecans succeed in almost any soil except deep, poor, sand, but more fertile the soil the better, They should be carefully cultivated to secure best results.

Hardy from Florida and Texas to Nebraska. Nuts vary in size and shape, from the very hard shell nuts to the very thin paper shell, which sometimes attain two and a half inches in length. Forms rarely reproduce themselves from seed.

The Paper Shell commands the highest market prices. In shape they vary from two and a half inches long by three-quarters, to one inch in diameter to other shapes approaching to the more globular, but the distinctive characteristic is the more or less thin shell, which is well filled by a sweet and well flavored kernel. Many forms of the paper shell class are now propagated and sold under recognized names, the best known of which follow in tabulated form:

EXPLANATION OF COLUMNS AND ABBREVIATIONS—1st, name of variety; 2d, origin; 3d, size—M, medium; L, large; VL, very large; 4th, shape—O, ovoid or plump; L, oblong; P, pointed; 5th, quality—G, good; VG, very good; B, best.

RATING—Same as for other fruit.

The following list includes those that have proved the best for Georgia. Several varieties formerly catalogued have been left out from the fact that they are not sufficiently meritorious. A few new and promising varieties have been introduced.

NAME	Origin	Size	Shape	Quality	Mountain Region	Middle Region	Southern Region	Coast Region	REMARKS.
Alley	Miss.	L	O	VG	*	*			* A very promising variety
Bradley	Fla.								New but promising.
Curtis	Fla.	M	OP	B	***	***			* Excellent quality.
Delmas	Miss	VL	LP	G	***	***			* Early and abundant bearer.
Frotscher	La.	L	O	VG	*****	*****			* Standard; healthy; reliable. Seedling of Columbian; very prolific.
Jerome	La.	VL	O	VG	*****	*****			* Seedling of Pride of the Coast, but greatly superior to it, and productive.
Moneymaker	La.	L	O	G	*	*	*		* Vigorous grower.
Nelson	La.	VL	LP	G	*	*	*		* A new and promising variety.
Pabst	Miss.	L	L	VG	*	*			* A standard; prolific.
President	Fla.	L	LP	G	*	*			* A new and promising variety.
Schley	Miss	L	LP	G	***	***			* Early bearer; quality best.
Stuart	Miss.	L	O	G	*****	*****			* Standard; an old favorite.
Success	Miss.	VL	O	VG	*	*			* New; very large; promising.
Teche	La.	M	OP	VG	*	*			* Very prolific; promising.
VanDeman	La.	L	LP	VG	*****	*****			* Standard; one of the best.

Hard-Shell Pecans vary in size and shape of nuts, the larger forms being two inches by three-quarters, and many are of excellent quality but as a commercial commodity do not command the high prices of the former.

NOTE—The impression prevails that whenever the tap root is cut in transplanting the tree never bears fruit. This is a ridiculous assertion and is misleading, as it is contrary to all past experience, because of the fact that most of the thousands of bearing Pecan trees found throughout the State, had their tap root sometimes reduced to a few inches in length.

### CHESTNUTS.

*American* (*Castanea dentata*). Nuts of medium size, usually three in a burr, the middle one flattened and sometimes imperfect, the outer ones plano-convex; flavor sweet, succeeds in almost any soil not too moist, but thrives best in rich, clayey or rocky soils in the upland districts. Many forms have been produced by careful selection of the largest nuts.

*Chinquapin* (*Castanea pumila*)—Nuts small, solitary in burr, flavor sweet. A small tree or large shrub, succeeding in much lower sections of the State than the chestnut. An improved form is disseminated under the name of "Rush Hybrid."

*European* (*Castanea vesca*)—In each country in Europe are found forms which seem specially adapted thereto, and known mainly under local names. The following may be classed as principal varieties and known as commercial sorts:

Ordinary—Nuts medium, very productive, usually propagated from seed and the varieties known as European or Spanish.

Exalade—Nuts large and considered of the best quality: tree rather dwarf and productive.

Pourtalonne—Nuts very large.

Green of Limousin—Large, and keeps sweet and a long time.

Combale—Nut very large and trees very productive.

Nourzillarde—Very large, and requires a warm soil and section.

Lyons, Luc, Lusignan, d'Agen, etc., are names given to the large nuts usually found in commerce.

Identical reproduction by seed is unreliable; fifty per cent. may be taken as a fair average. The best varieties are increased by grafting.

*Japan*—This is a distinct type, resembling the European more closely than the American, and contains many forms. Nuts grown upon seedling trees vary remarkably in size, some being scarcely as large as the American sweet chestnut, whereas others are larger than any of the European sorts. Hence the best forms can only be reliably propagated by grafting. The word Mammoth can not always be applied to seedlings, because of the great variation in size.

The true Mammoth as produced upon grafted trees, is of very large size, sometimes attaining one and three-quarters by one and one-half inches. Flavor sweet but inferior to the European sorts. Burrs often producing four to five nuts, and occasionally as many as seven. Trees are very dwarf growth, and begin to bear fruit at two years from graft, but seem to be short lived.

The following tabulated list includes the varieties of the EUROPEAN (or *Spanish*) and JAPANESE types most commonly disseminated:

EXPLANATION OF COLUMNS AND ABBREVIATIONS—1st, name, variety; 2d, size of burr—S, small; M, medium; L, large; VL, very large; ML, medium to large; 3d, size of nut—abbreviations same as for burr; 4th, maturity.

RATING has been omitted with this nut, although nearly every variety will succeed in the Mountain Region, many in the Middle Region, and a few in the Southern Region.

NAME	Size of Burr	Size of Nuts	Maturity	Rating			REMARKS.
				Northern Region	Middle Region	Southern Region	
(European Type.)							
Scott	M	M	L				
Hannum, (syn., Styer)	M	M	M				
Numbo	M	L	E				Standard early variety.
Paragon	VL	L	M				Standard; midseason; productive.
Ridgely	ML	ML	L				Standard late variety.
(Japanese Type.)							
Advance	M	VL	VE				Earliest of all; very large.
Biddle	M	L	L				
Black	L	L	E				
Coe	L	VL	L				Of excellent quality.
Kent	S	ML	E				Early bearer.
Kerr	S	ML	M				Very prolific; of good quality.
Killen	VL	VL	L				Reputed as best of the Japanese type.
Martin	L	VL	L				Tree vigorous; quality of nut inferior.
McFarland	VL	L	VE				Large, very early; fine quality.
Parry	VL	VL	L				Standard; very large and fine.
Reliance	M	ML	L				Precocious and heavy bearer.

## ALMONDS.

As a rule unsuited to the State of Georgia owing to fruit blooms being injured by spring frosts. Occasionally successful in the Coast and Southern Regions. Suited to the Pacific Coast and West of Rocky Mountains.

**Hard-Shell**—This section comprises several varieties with sweet and bitter kernels. The latter resist spring frosts better than the sweet varieties, and often yield good crops of nuts, which are, however, of little value for culinary purposes. Where successful, the following sub-varieties produce sweet nuts: *Ordinary, Large Green, Half Hard Shell*, all sweet nuts; *Malherone, Moliere, Pistache*.

**Soft or Paper Shell, Princess, Sultana, Heterophylle**—This is the most esteemed for using in a fresh state. Peach Almond, a variety with occasionally a fleshy hull, in this resembling a peach. Of little value as a fruit.

### FILBERTS. (Corylus Avellana.)

These are divided into two classes: 1. Filberts, or with long husks. 2. Hazlenuts, or with short husks. These plants thrive best in light but rich soils, and not too dry. Plants must be trained to single stems and very low heads, all suckers carefully removed. The best varieties are *Cosford, Kentish Cob, Lombard, Purple Filbert, White Filbert*.

### PEARS.

**EXPLANATION OF COLUMNS**—1st, name of variety; 2d, season; 3d, use; 4th, stock upon which the variety succeeds best; remainder, the region in which the varieties are recommended.

**ABBREVIATIONS**—Season and Use, same as those for Apples. Stock—Q, (dwarf) quince; S, (standard) pear stock. Where not marked, the varieties thrive equally upon quince or pear.

NAME.	Season	Use	Stock	Mountain Region	Middle Region	Southern Region	Coast Region	REMARKS.
Bartlett.....	S	M	S	***	***	***	**	Good everywhere, but subject to blight.
Belle Lucrative.....	S			***	***	***	*	Good for family use.
Beurre Bosc.....	A	S	S	***	***	***	**	Variable as to soil.
Beurre Clairgeau.....	A	S	S	***	***	***	**	Apt to lose its foliage.
Beurre d'Anjou.....	S	M	Q	***	***	***	**	Very Good.
Beurre Diel.....	A			***	***	***	*	Good.
Beurre Easter.....	W	S		***	***	***	*	A late keeper.
Beurre Giffard.....	ES	Q		***	***	***	*	Very early; open growth.
Beurre Langelier.....	A			***	***	***	*	Very fine in Mount'n Region.
Beurre Superfin.....	S	M		***	***	***	*	Excellent, but rots at the core.
Clapp's Favorite.....	S	M	S	***	***	***	*	Very good; fine color; matures rapidly, stan-
Doyenne d'Ete.....	ES			***	***	***	*	Good; very early but small. (dard only.
Doyenne Boussock.....	S	S		***	***	***	*	Slow bearer.
Duchesse d'Angouleme.....	S	M	Q	***	***	***	**	Most profitable of all on quince.
Early Harvest.....	E	F	S	***	***	***	*	Suited to some sections.
Flemish Beauty.....	S	M	S	***	***	***	**	Good, but liable to rot at core.
Gasber.....	S	M	S	***	***	***	*	Oriental type, good; follows Leconte.
Howell.....	S	M		***	***	***	*	Very good.

# PEARS—Continued.

NAME.	Season	Use	Stock	Mountain Region	Middle Region	Southern Region	Coast Region	REMARKS.
Kieffer.....	A	M	U	**	**	**	**	Productive and valuable as a late pear.
Lawrence.....	S	M	U	**	**	**	**	Large and fine; fine grower; best on standard
Louise Bonne de Jersey.....	A							* Variable as to quality.
Leconte, (syn., Chinese Pear).....	S	M	U	**	**	**	**	Valuable in South Georgia; very good for
Mikado.....	A							Good for canning. (table and market.
Mme. Von Seibold.....	A							Good for canning.
Onondaga.....	S	M	U	**	**	**	**	Vigorous grower; good quality.
Osband's Summer.....	S							
Ott.....	VE							Small, but excellent and productive.
Petite Marguerite.....	VL							Seedling of Doyenne d'Ete, and better.
Reliance.....	S		U					Excellent quality; reliable bearer.
St. Michael Archangel.....	S			**	**	**	**	Fine grower; good fruit.
Seckel.....	A	M	C	**	**	**	**	Slow bearer; fruit best quality.
Sheldon.....	LS	T	S	*	*	*	*	
Stevens' Genesee.....	S			*	*	*	*	
Smith's.....	ST	T	S	*	*	*	*	Oriental type; resembles Leconte, but little
Wilder.....	VE	T	S	**	**	**	**	Showy, small, good, but slow bearer. (earlier.

## BEST VARIETIES FOR MARKET IN ORDER OF MATURITY.

ON QUINCE—Beurre Giffard, St. Michael Archangel, Howell, Duchesse d'Angouleme, Seckel, Beurre d'Anjou.

ON STANDARD—Doyenne d'Ete, Wilder, Clapp's Favorite, Beurre Superfin, Bartlett, Belle Lucrative, LeConte, Flemish Beauty, Seckel, Beurre Clairgeau, Lawrence, Kieffer, Beurre Easter and Winter Nelis.

JAPANESE TYPE—Mikado, Garber, Mme. Von Seibold, Magnolia and Golden Russet. Very productive and valuable for canning and evaporating only.

## PLUMS.

(Native and European.)

EXPLANATION OF COLUMNS—1st, name of variety; 2d, color; 3d, class—whether free or clingstone; 4th, season; remainder, region in which the varieties are recommended.

ABBREVIATIONS—Color—R, red; Y, yellow; B, blue; G, green; P, purple or purplish. Season—As for Peaches. Class—C, clingstone, F freestone.

# PLUMS—Continued.

NAME.	Color	Class	Season	Rating.				REMARKS.
				Mountain Region	Middle Region	Southern Region	Coast Region	
Type Hortulane—Wild Goose Group.								
Cumberland	Y	C	VL	*	*	*	*	Productive; poor quality.
Wild Goose	R	C	E	*	*	*	*	Inferior to Clifford and Wilder.
Type—Chickasaw:								
Beauty	R	C	M&L	*	*	*	*	Very productive; season lasts five weeks.
Hughes	R	C	M&L	*	*	*	*	Over productive; holds fruit five weeks.
Munson	YR	C	VE	*	*	*	*	Productive, juicy; good family plum.
Type—Cerasifera:								
DeCaradenc	R	C	VE	*	*	*	*	Very productive; good shipper, but inferior quality.
Type—Myrobalana:								
Pissard Prunus Pissardii, or Persian Purple-leaved		C		*	*	*	*	Valuable only as a forage plant.
Type—European:								
Bradshaw	R	F	M	*	*	*	*	The Curculio and brown rot prevent this class of plums from being raised to any extent. Where special care is taken to destroy the insects, the varieties marked * are recommended.
Coe's Golden Drop	Y	C	M	*	*	*	*	
Columbia	P	F	M	*	*	*	*	
Damson, (syn., Black)	B	F	E	***	*	*	*	
Duane's Purple	P	C	M	*	*	*	*	
Green Gage	G	F	M	*	*	*	*	Good quality in mountains.
Imperial Gage	G	F	M	*	*	*	*	
Lombard	P	C	M	*	*	*	*	
Mogul, (syn., Morocco)	B	C	M	*	*	*	*	
Monroe	G		M	*	*	*	*	
Moore's (Arctic)	P		M	*	*	*	*	Profuse bearer.
Orleans (Smith's)	P	F	M	*	*	*	*	
Red Gage	P	F	M	**	*	*	*	
Shipper's Pride	P	F	M	*	*	*	*	
Washington	Y	F	M	*	*	*	*	
Yellow Gage	Y	F		*	*	*	*	

## JAPANESE PLUMS.

*Prunus Triflora* of Botanists—*Prunus Japonica* of Pomologists.

For many years past efforts have been made to simplify their nomenclature and remove the perplexing synonymy resulting from the Japanese names, which usually refer to a class or type or the locality from which trees are exported, and have resulted in the confusion which has existed in their nomenclature. Specific names have lately been adopted by leading American Pomologists, and plums disseminated under these.

ABBREVIATIONS AND EXPLANATIONS—Same as for Native and European Plums. Synonyms entered in small type after the accepted name of each variety.

**JAPANESE PLUMS—Continued.**

NAME	Color	Class	Maturity	Rating			REMARKS.
				Mountain Region	Middle Region	Southern Region Coast	
Abundance.....	YR	C	E	***	*	*	One of the best; reliable; good quality and shipper.
Botan.							
Yellow Flesh Botan.							
Babcock.....	R	C	VL				Differs but slightly, if any, from Chabot
Chabot (?)							
Berckmans.....	YR	C	M	*			Quality good in some sections; appearance attractive.
True Sweet Botan.							
Burbank.....	YR	C	L	***	*	*	Large; apt to overbear; of drooping habit; good shipper.
Wassu.							
Chabot.....	R	C	VL	**	*	*	Excellent late variety; good shipper.
Bailey.							
Chase.							
Furujiya.							
O'Hattankio.							
Douglas.....	R	C	VL	**	*	*	Closely resembles Chabot.
Hytankayo.							
Munson.							
Georgeson.....	Y	C	L	*			Good quality; suitable for local market.
Hattankio No. 1.							
Mikado.							
Prolific.							
Kelsey.....	P	SC	VL	*	*	*	Large, excellent quality; variable; rots unless surface soil is not disturbed; merely kept free of weeds.
Kerr.....	Y	C	E	*	*	*	Excellent early plum, but of weak constitution.
Hattankio No. 2.							
Oblong Hattankio.							
Lutts.....	P	C	VE				Earliest of this list; good size; desirable.
Wasse-Botankio.							
Ogon.....	Y	F	E	*			Good freestone; light bearer.
Shizo Smomo.							
Red June.....	R	C	VE	***	*	*	One of the best; large and fine; profitable market sort.
Nagate-no-Botankio.							
Red Nagate.							
Satsuma.....	P	C	VL	*			Unreliable in some sections; fine quality best for canning.
Yone-momo.							
Yone-smomo.							
Sagetsuma.....	YR	C	VE				Large, handsome; promising.
Simoni.....	R	C	M				Large, flat, bright red; fine flavor but unreliable.
(Crossed Varieties.)							
America.....	YR	C	M	*	*	*	Productive, but of poor quality.
Botan and Robinson.							
Apple.....	P	C	L	*	*		Closely resembles Satsuma.
Satsuma and Robinson.							
Bartlett.....	R	C	E				Excellent quality; very promising.
Delaware and Simon							
Chalco.....	P	C	L	*	*	*	Very large and firm; very promising.
Simon and Burbank.							
Climax.....	R	C	E				Very large; delicious; promising.
Abundance and Simon.							
Combination.....	R	C	M	***	*	*	Of best quality; large and handsome.
Doris.....	R	C	L				Light bearer.
Robinson and Abundance.							
Gonzales.....	YR	C	M	*	*	*	Large, fine, promising.
Wickson.....	R	C	VL	*	*	*	Very large and fine if surface soil is not disturbed.
Petriflora and Simon.							

# NATIVE GRAPES.

EXPLANATIONS OF COLUMNS—1st, name; 2d, variety; 3d, season; 4th, use; remaining columns for regions, etc.

ABBREVIATIONS—Color—W, white, B, blue or black; R, red; PB, pale blue. Season—E, early, maturing from beginning to end of July; M, medium, maturing from end of July to August 15; L, late, maturing after middle of August; VL, very late, maturing after middle of September. Use—M, market; T, table; W, Wine.

NAME.	Color	Season	Use	Rating.			REMARKS.
				Mountain Region	Middle Region	Southern Region	
Type Labrusca; Fox Grape.							
Catawba.....	R	M	W	*	*	*	(gaining its old standard.
Concord.....	B	M	MW	*****	*****	*****	Less liable to rot than formerly; re-
Diana.....	PR	M	TM	*****	*****	*****	Among our best varieties.
Ives.....	B	M	WM	*****	*****	*****	Good quality; good bearer and shipper.
Moore's Early.....	B	VE	M	***	*	*	Prolific and no rot.
Niagara.....	W	M	M	*****	*****	*****	An early shipper.
Perkins.....	R	M	M	*	*	*	Profitable as a white market grape.
Worden.....	B	M	M	***	---	---	Good bearer; no rot; second quality.
Labrusca Hybrids:							
Agawan.....	R	M	P	*	*	---	Larger than Concord.
Barry (Rogers' 42).....	B	M	T	*	*	---	
Brighton.....	R	E	T	**	*	---	Very good quality; good bearer.
Diamond.....	W	E	TM	***	---	---	Very early; white.
Goethe (Rogers' 1).....	PR	L	T	***	*	---	Good; late; requires sacking.
Lady Washington.....	W	M	T	*	*	---	Moderate grower.
Lindley (Rogers' 9).....	R	M	T	*	*	---	Good.
Merrimac (Rogers' 19).....	B	M	T	*	*	*	Suitable for amateur culture.
Peter Wylie.....	W	M	T	*	*	*	Best quality.
Salem (Rogers' 53).....	R	M	M	*	*	*	Good.
Wilder (Rogers' 4).....	B	M	T	*	*	*	
Type Aestivalis, Summer Grape.							
Carman.....	B	M	TM	*	---	---	Very showy and good.
Cunningham, (Syn., Long).....	PB	M	W	*	*	---	Good but not productive.
Devereaux, (Syn., Black July).....	B	M	TW	**	*	*	Excellent; shy bearer while young.
Herbemont, (Syn., Warren).....	PB	L	W	*	*	**	Apt to rot; excellent quality.
Lenoir.....	B	M	W	*	*	*	Rots in Middle region; excellent for wine
Norton's Virginia.....	B	L	W	***	*	**	Best for red wine.
Aestivalis Hybrids:							
Delaware.....	PR	E	TMW	*****	*****	*****	Best table variety; reliable; slow grower

# GRAPES—Continued.

NAME	Color	Season	Use	Rating.				REMARKS.
				Mountain Region	Middle Region	Southern Region	Coast Region	
Type Riparia, or Riverside Grape:								
Clinton .....	B	M	W	*	*	*	*	Good for red wine.
Riparia Hybrids:								
Berckmans .....	R	M	T	**	*	*	*	Vigorous; better grower than Delaware.
Elvira .....	W	M	W	*	*	*	*	
Missouri Riesling .....	W	M	TW	*	*	*	*	Good for white wine.
Presly .....	R	VE	T	*	*	*	*	Promising as earliest of all.
Type, Rotundifolia:								
Flowers .....	B	VL	W	*	*	*	*	The latest of the type.
James .....	B	L	TW	*	*	*	*	Very large berry; poor quality.
Scuppernong .....	W	L	TW	**	**	**	**	Most certain bearer; good wine grape.
Tenderpulp .....	B	L	TW	*	*	*	*	Pulp dissolving.
Thomas .....	PB	E	TW	**	**	**	**	An excellent early variety.

## BEST VARIETIES FOR MARKET IN ORDER OF MATURITY.

Moore's Early, Diamond, Moore's Brighton, Ives, Delaware, Niagara, Concord, Perkins, Diana, Catawba, Worden.

## BEST VARIETIES FOR WINE.

Red—Norton's Virginia, Lenoir, Clinton, Concord, Ives, Thomas.

White—Missouri Riesling, Catawba, Delaware, Elvira, Warren, Noah, Scuppernong.

## EUROPEAN.

Are only suited for cold graperies, the best are Black Hamburg, Muscat of Alexandria, white Chasselas, etc.

## STRAWBERRIES.

EXPLANATION OF COLUMNS—1st, name; 2d, sex; 3d, origin; 4th, use; 5th, season.

ABBREVIATIONS—Sex—P, Pistillate; H, hermaphrodite or bisexual. Use—F, family; M, market; LM, local market. Season—E, early; VE, very early; L, late.

NAME.	Sex	Use	Season	Rating.				REMARKS.
				Mountain Region	Middle Region	Southern Region	Coast Region	
Bederwood	H	LM	E	..	*	..	..	Very productive, but small.
Belmont	H	F	M	..	*	..	..	Long; suitable for rich soil.
**Brandywine	H	M	M&L	..	**	..	..	Large; productive.
*Bubaek (No. 5)	P	M	L	..	***	..	..	Excellent. (market.)
*Clyde	H	LM	M	..	*	..	..	Excellent for family use and local
Clyde Cumberland								Very productive but poor color; will pay when berries are cheap.
*Cumberland	H	M	M	..	*	..	..	
Excelsior	H	FM	VE	..	*	..	..	Early but small.
**Gandy	H	FM	VL	..	**	..	..	Excellent late berry; very large.
Greenville	SP	F	M	..	*	..	..	A light bearer; good size.
*Haverland	P	M	L	..	**	..	..	Productive; large and long.
Hefflin	H	LM	E	..	*	..	..	Very large and handsome.
Hoffman	H	M	VE	..	*	**	..	Standard early shipper. Good in Flor-
Howell	H	LM	M	..	*	..	..	(ida.)
**Lady Thompson	H	M	E	**	**	**	**	Promising.
Michel	H	M	VE	..	*	..	..	Best market variety.
Pride of Cumberland	H	FM	L	..	*	..	..	Very early; shy bearer.
Sample	P	FM	L	..	*	..	..	Large, productive; desirable.
Seaford	P	LM	M	..	*	..	..	Large, productive; desirable.
Sharpless	H	F	M	..	*	..	..	Excellent quality; large.
*Wilson	H	M	M&L	****	*	..	..	Size large and quality good.
								An old favorite.

## RASPBERRIES.

(EXPLANATIONS AND ABBREVIATIONS as for other fruits.)

NAME	Size	Color.	Rating.					REMARKS.
			Season.	Mountain Region.	Middle Region.	Southern Region.	Coast Region.	
1. Black-Caps:								
Conrath.....	L	B	E	*	*	*	*	Very promising; large and fine.
Cumberland.....	M	B	M	*	*	*	*	Heavy cropper.
Gregg.....	M	B	M	***	***	***	***	Best of the black-caps.
Souhegan.....	S	B	E	***	***	***	***	Early.
2. American Reds:								
Cuthbert.....	L	R	M	****	****	****	****	Best and most reliable.
Golden Queen.....	M	Y	M	*	*	*	*	Productive and of first quality.
King.....	M	R	M	*	*	*	*	Promising.
Loudon.....	L	R	M	****	****	****	****	Large, handsome, heavy.
Miller.....	M	R	E	*	*	*	*	Promising.
Turner.....	S	R	M	*	*	*	*	Heavy bearer; of good quality.
3. Purple Cane Group:								
Caroline.....	M	Y	E	*	*	*	*	Handsome; productive.
Columbian.....	L	P	E	*	*	*	*	Vigorous and productive.
Reliance.....	M	P	M	*	*	*	*	Good.
Shaffer.....	L	P	L	*	*	*	*	Late; productive; good shipper.

## BLACKBERRIES.

NAME	Size	Color.	Season.	Rating.			REMARKS.
				Mountain Region.	Middle Region.	Southern Region.	
Austin's Improved or (syn. Maye's Hybrid).....	L	B	VE	*	*	*	A large Dewberry; profitable for market.
Early Cluster.....	L	B	E	*	*	*	Very handsome, early.
Erie.....	L	B	M	*	*	*	One of the best.
Early Harvest.....	S	B	VE	*	*	*	Valuable as a very early berry.
ElDorado.....	L	B	E	*	*	*	Heavy bearer, valuable.
Iceberg.....	M	W	E	*	*	*	Best white; productive.
Kittatinny.....	M	B	M	*	*	*	Late.
Mercereau.....	L	B	E	*	*	*	Very hardy, large and good.
Ohmer.....	VL	B	M	*	*	*	Best very late berry.
Taylor's Prolific.....	M	B	VL	*	*	*	Very early, 10 days ahead of Early Harv- (est.
Trinity.....	S	B	E	*	*	*	Good quality.
Wilson's.....	L	B	E	*	*	*	Very prolific; best white variety.

## MULBERRIES.

Downing's.....	M	P	E&L	*****	Good flavor, acid; moderate bearer.
Hicks'.....	M	P	E&L	*****	Inferior fruit; very prolific, recommended for poultry and hogs.
Stubbs'.....	VL	P	E&L	****	Large, very best; immensely productive.

# FIGS.

EXPLANATION OF COLUMNS—1st, name; 2d, size; 3d, color; 4th, season; remaining columns for regions, etc.

ABBREVIATIONS—Size—S, small; L, large; M, medium. Color—W, white. Season—E, early; M, middle season; E and L, early and late.

NAME	Size.	Color.	Season.	Mountain Region.	Middle Region.	Southern Region.	Coast Region.	REMARKS.
Angelique, (syn., Early Lemon)	S	W	E	*	*	*	*	Small; good; early.
Brunswick, (syns., Madonna, Con sple)	L	P	L	**	**	**	*	Very large and desirable.
Black Ischia	L	B	M	**	**	**	*	Good quality.
Black Provence	S	B	FL	**	**	**	*	A good second to Celestial.
Brown Turkey	M	B	I	**	**	**	*	Best of all for Middle Region.
Celestial	S	V	E	*****	*****	*****	*****	Small; prolific and desirable; hardy.
Green Ischia, (syns., White Ischia, Green Italian)	M	G	ML	*****	*****	*****	*****	Very good; excellent quality.
Lemon	M	Y	E	*****	*****	*****	*****	Good.
Neyreil	M	W	E	*****	*****	*****	*****	Good; very early.
Marseilles	M	W	M	*	*	*	*	Rather dry, but prolific.
Violet Round	M	W	M	*	*	*	*	
Magnolia	L	B	M	**	**	**	**	Large and productive.

## CHERRIES.

EXPLANATIONS AND ABBREVIATIONS same Figs, except color. R. red; A, amber; DR, dark red, or nearly black; Y, yellow; YR, yellow red.

NAME	S.e.	Color.	Season	Mountain Region.	Middle Region.	Southern Region.	Coast Region.	REMARKS.
Belle de Choisy.....	M	DR	M	**	*			Prolific.
Belle et Magnifique.....	M	R	M	***				
Black Heart, Werder's.....	L	DR	E	**	*			A standard sort.
Black Tartarian.....	L	DR	M	***				Very early.
Black Eagle.....	L	DR		**	*			Cherries are uncertain in Middle region,
Beauman's May.....	L	R	E	**	*			except in a few localities, where good
Carnation.....	M	R	M	**	*			crops are sometimes produced, the
Coe's Transparent.....	S	AY	M	*	*			Morello class being most desirable.
Dyehouse.....	M	R	VE	**				Trees should all be grown on Mahaleb
Early's Richmond.....	M	R	E	***				stock.
English Morello.....	M	R	L	**	*			
Governor Wood.....	L	R	M	***				
May Duke.....	L	R	E	***				
Montmorency (Ordinaire).....	M	R	L	*				
Napoleon.....	L	R	M	*				
Rockport.....	L	AR	E	*				
Reine Hortense.....	L	R	M	*	*			
Wragg.....	M	P	L	**				
Yellow Spanish.....	L	R	M	***				Reliable.

## QUINCES.

NAME.	Mountain Region.	Middle Region.	Southern Region.	Coast Region.	REMARKS.
Augers.....	*	*	*	*	Fine quality.
Chinese.....	**	**	*	*	Succeeds best in Southwest Georgia; good for pre-
Orange or Apple.....	*	*	*	*	serving.
Portugal.....	*	*	*	*	Most generally cultivated.
Rae's Mommoth.....	*	*	*	*	Large and good.
Meech.....	**	*	*	*	Early and large.

Quinces need strong clay soil. All, except Chinese are unproductive in gray land.

## JAPAN PERSIMMONS.

(*Diospyros Kaki*.)

It is almost impossible to give an accurate nomenclature, owing to the confusion which exists in the collections imported from Japan. These collections seldom contain more than twelve varieties; yet when the trees bear fruit, the same name is often found to apply to several distinct varieties, or one variety has several names. The best and most distinct varieties have been included in this list, and with such synonyms added thereto as have been ascertained after several years' trial; and while no claim is laid to strict accuracy, the aim has been to reach this as nearly as possible.

All the varieties are hardy in the Middle and Coast Regions, and occasionally in the Mountain Region.

The fruit is usually of a bright orange red or vermillion, the color being more or less intense, according to variety, and begins to color when half grown, but should be allowed to hang upon the trees until just before frost is expected; or with the early ripening varieties until fully soft. If gathered before frost there is a slight astringency next to the skin, but this disappears after being kept in the house for a few days or weeks. If allowed to be slightly touched by frost, the flavor is much improved, but it will then not keep many days. It is, therefore, desirable to gather the fruit before frost, if intended for keeping, and then some varieties will keep until January or February. The flesh is soft, rich and sweet, and with a slight apricot flavor. The fruit should be eaten with a spoon.

Some varieties are apt to overbear, and should have the fruit thinned as soon as set in April.

Trees are propagated mainly by grafting upon the collar of the roots and upon the native species. Seedlings vary in size, shape and quality, but as the largest proportion are male plants, and those which are fruitful are apt to produce small and worthless fruit, very little reliability can therefore be placed upon seedlings, so far as yielding edible fruit.

*Among*, or *Yemon* (name of a Japanese ornament)—Round, flattened, deeply ribbed, dark orange red, and sometimes yellowish red, two and a half to three inches in diameter, average weight six ounces, and occasionally a specimen weighing sixteen ounces is produced. Very sweet, flesh red, and is edible while still solid, quality improves as it becomes soft. Maturity, September to end of November. Trees of moderate height.

*Hachiya* ("Beehive" in Japanese)—Synonyms: *Costata*, *Imperial*, *Yomato*, etc. Oblong, with blunt apex, slightly ribbed, two and a half by three inches; average weight five ounces. Flesh deep orange red; astringent while solid, but sweet and very good when soft. Should be house-ripened and can be kept until March. Tree of vigorous and tall growth.

*Hiyakume* (weighs one hundred "me," a unit of Japanese weight)—This is perhaps the most desirable of all the round, red fleshed varieties and as the fruit affects various shapes, it is known under many names, such as Pound, Tane-nashi, or Seedless, etc. The Agricultural Bureau of Tokio gives the latter name to a variety with black mottled apex, but we find both round and elongated forms upon the same tree, as also uniformly orange and orange yellow colored specimens, while many are heavily tipped with black. The variation of forms and colors doubtless led to its array of synonyms. Fruit large, average three inches in diameter, and five ounces in weight; usually flattened, but elongated forms are quite common upon the same branch. Flesh bright orange red. Keeps very late. Must be soft before being edible. Tree of moderate height; apt to be of dwarf growth.

*Ioyama Gaki* (name of locality)—Medium to large, round but somewhat narrower at the apex; yellowish orange, with dark black pencilings at apex. Flesh dark brown or grayish brown; very sweet. Can be eaten when solid; four to six ounces.

*Kurokuma* (This may possibly be Goshio-hira, or Palace Persimmon)—Very large, round, somewhat flattened; three to three and a half inches in diameter; average weight ten ounces, and sometimes yields specimens of sixteen ounces in weight; keeps late. Flesh red. Tree erect grower.

*Miyo-tan*—Synonym: Mazelli. Round or slightly oblong, two and a half inches in diameter; average weight five and a half ounces; slightly ribbed. Skin deep orange red. Flesh usually deep brown red; but bright red or half red and half brown fleshed specimens are often produced upon the same tree, the results of cross-fertilization by other varieties. Tree of medium or dwarf growth; exceedingly prolific. Fruit keeps very late. The brown fleshed specimens are edible while solid, and as early as October 1.

*Okame* ("Stout young girl" in Japanese)—Synonyms: Oblong Hyakume, Mikado, etc.; medium to large, two and a half by three and a half inches; deep red; nearly always seedless; keeps late.

*Tsuru-no-ko* ("Stork Egg")—Synonym: Minokaki ("Persimmon from Mino," a locality.) Large, oblong, pointed, two and a half by three and a half inches; weight four to five ounces, sometimes ten ounces. Skin bright red; some specimens black at apex. Flesh red, very good. Keeps late; edible only when soft. Foliage long and shiny; tree compact and vigorous grower. This variety varies very much as to size at different seasons.

*Yedo-Ichi* ("No. 1," or "best in Yedo," latter being the old name of Tokio)—Synonym: Maru-Gata ("round shape.") Medium, round, some specimens slightly oblong, flattened at base and narrowing at apex, skin dark red, often with black mottlings near apex; flesh mahogany brown, with darker spots, brittle and is edible while solid, as early as

October 1. Very prolific and bears fruit in large clusters. Tree an upright grower.

*Zenji*, or *Zingi* (name of Japanese village.) Small, one and three-fourths by two inches; weight three to four ounces. Flesh dark brown, with darker spots; very sweet. Edible as early as middle of September, while still solid, and lasts throughout October.

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# Georgia State Board of Entomology

BULLETIN No. 31

JANUARY, 1910

## The San Jose Scale and Some Experiments for Its Control

STATE CAPITOL

ATLANTA, GA.

By  
E. L. WORSHAM and  
W. W. CHASE



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**E. L. WORSHAM, STATE ENTOMOLOGIST**

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**BULLETIN NO. 32**

**MARCH, 1910**

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## **PART I.**

### **PLUM CURCULIO AND METHODS FOR ITS CONTROL**

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## **PART II.**

### **BROWN ROT EXPERIMENTS FOR SEASON OF 1909**

**STATE  
CAPITOL**



**ATLANTA,  
GA.**

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**Georgia State Board of Entomology**  
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**PART I**  
  
**THE PLUM CURCULIO AND METHODS  
FOR ITS CONTROL.**

**By**

**W. W. CHASE.**

**INTRODUCTION.**

All Georgia peach growers are familiar with the work of the plum curculio (*Conotrachelus nenuphar*, Herbst.). Each year in all sections of the State where fruit is grown, a heavy toll is paid through the ravages of this beetle. The yearly injury resulting from the attacks of this insect is seen in the vast quantities of wormy peaches discarded at the packing shed; in the numberless windfalls on the ground; and is oftentimes felt in the realization of poor prices in the market. The injury is not alone confined to the peach crop. Plums and apples suffer as well, and other fruits such as pears, cherries, etc., in less degree.

Although, as has been stated, the loss is felt annually, it is also true that it is greater some years than others. Certain conditions of orchard location and cultivation materially affect the volume of curculio infestation in different fruit growing

sections. Orchards situated near woods or thickets and not cleanly cultivated are subject to greater losses than those further removed from timbered land and kept cleanly and thoroughly cultivated at all seasons. The beetle hibernates during the winter in adult form in protected places; under rubbish and tree bark, and in old stumps or similar places, emerging in the early spring ready to begin egg laying in the fruit when it is first uncovered from the bloom. It may readily be seen, therefore, that conditions favoring the protection of the insect in winter account largely for the amount of damage in different sections.

### **HISTORY OF EXPERIMENTS IN GEORGIA FOR THE CONTROL OF THE PLUM CURCULIO.**

Soon after the organization of the Georgia State Board of Entomology, complaints of financial losses in the peach industry were made to the Entomologist by some of the larger growers, and led to the first experimental efforts to control it in this State. Experiments were conducted in 1902 by Mr. W. M. Scott, then Entomologist for Georgia, in the orchards of the Hale Orchard Company at Fort Valley. The familiar method of jarring for the beetles was given a trial on an extensive scale and resulted in a considerable reduction of the percentage of wormy peaches when it was tried. Spraying with Disparene (arsenate of lead) was also given a trial, but caused such a heavy defoliation of the trees and burned and shriveled the fruit so badly that it was declared impracticable.

Further experiments with this insect along any lines were discontinued by the Department until 1907, when they were renewed by Mr. W. W. Chase, Assistant to Mr. R. I. Smith, at that time Entomologist. This series of experiments covered a period of three years, being brought to a conclusion in 1909 under the direction of Mr. E. L. Worsham.

In 1907 and 1908 the experiments were conducted in Messrs. Berckmans Bros.' orchards at Mayfield, and concluded in the Bagley-Gober orchards at Bagley, Ga., near Americus. To both these companies, collectively, and to the several members of each, individually, the Department is indebted and grateful

for the material and helpful aid extended in pursuance of the work.

The series of experiments herein considered embraces two methods of control, viz., (1) jarring and (2) liquid spraying with arsenical poisons. The plan of the work at Mayfield was given over entirely to spraying with arsenicals, but at Bagley in 1909, both spraying and jarring were separately considered. Having these methods tested almost side by side, it was possible to determine what value each has as a control for curculio, and to draw a comparison of the relative cost of fighting the insect by the methods mentioned above.

The results of all the work herein recorded refer only to peaches, no other fruit crop having a place in the experiments. Wherever the word "fruit" is used with reference to any part of the experiments, peaches are meant. The points in the life history of the curculio mentioned herein were worked out at Bagley in the summer of 1909. These facts are stated in order that there may be no confusion as to the meaning of terms, and to avoid repetition in the following pages, as far as possible.

### **LIFE HISTORY OF THE PLUM CURCULIO.**

The adult curculio emerges from hibernation early in the spring, about the time dormant vegetation resumes growth. In the latitude of Americus it makes its first appearance in small numbers the latter part of March, and, as the weather grows steadily warmer, the curculios forsake their winter quarters in ever increasing numbers until about the middle of April. The first beetle found at Bagley (1909) was captured the twenty-second of March, though it is not probable that the emergence of over-wintering curculios was complete until about the fifteenth of April.

Mating begins almost co-incidentally with the first appearance and the deposition of eggs follows even before the bloom is off the young peaches.

Egg laying continues during the entire season, being most rapid during the latter part of April and in May, and decreasing toward the end of the peach season. The majority of the beetles have ceased egg-laying activity by the first of August, but it is very common to see peaches that ripen at that time bearing newly hatched larvae.

The eggs hatch within four or five days, and the larvae at once begin to eat their way into the fruit, rapidly growing in size as they feed. The peach, owing to the growth of the larvae within it and the destruction of the fruit tissue, falls to the ground, and the larvae when approximately three weeks old, eat their way from the peach and work their way into the ground to enter the pupal stage.

As pupae, the beetles remain underground about four weeks, emerging at the expiration of that time, as perfect beetles. This new brood of beetles feeds upon the fruit just as its progenitors, but there is no mating among them until the following spring.

Numbers of this new brood were kept in confinement and given a supply of peaches for feeding purposes, but there was never an instance of egg-laying noted, although they were kept so confined for more than thirty days. The new generation feeds freely upon the fruit and adds volume to the injury still being worked by the old generation. The last act of the first year's life of the new beetles in seeking their hibernating security, completes the life cycle.

## **LIFE HISTORY IN DETAIL.**

### **The Egg.**

The female curculio prepares for ovipositing by eating a cavity in the fruit to receive the egg. This cavity, when finished, varies somewhat in size. In one instance it may be just large enough to contain the egg, or it may be even too small fully to conceal the entire egg. Again, the hole is made larger than the egg itself, and the curculio may take the precautionary measure of protecting the egg from injury or destruction by packing the unfilled portion of the cavity with very small pieces of the pulp, obtained while excavating the hole.

The egg when first laid is small, white in color and oval in shape. The color quickly changes, however, and becomes yellowish or brown. The egg puncture is usually characterized by a crescent shaped mark which the female curculio cuts above it. This mark, however, is not invariably a rule as a finishing touch to oviposition. It is very common to find egg punctures with no accompanying crescent, and it is, perhaps, yet more common to find the crescent without the egg. Fig. 1



**Fig. 1.—Peach showing egg puncture with crescent cut above the egg. Natural size (original).**



**Fig. 2.—Small plums bearing characteristic crescent shaped egg punctures. Natural size (original).**

shows the crescent mark on a peach and Fig. 2 also shows a similar mark on a plum.

The egg laying period of the average individual female lasts nearly the entire period necessary for the development and maturity of the later varieties of Georgia's commercial peaches.

or about four months. During this time it is possible for her to lay a great many eggs. An instance is recorded where a single female deposited nearly four hundred and fifty within a period of less than three months. When this is considered it is easy to see why there are so many "wormy" peaches. A considerable percentage of the eggs never hatches for various reasons. Some are unfertilized while others are destroyed by predaceous insects, and for other causes fail to produce larvae.

The egg stage of the curculio lasts approximately four or five days, and from the egg emerges the minute larva or "worm," as it is commonly called.

### **The Larva.**

Every one is familiar with the little white, footless grub that so often inhabits the interior of an externally beautiful peach. We find them with a displeasure which is greater when a generous, luscious bite reveals only a half worm instead of a whole one.

When first hatched the larva is very minute, almost too small to be seen with the naked eye, but grows rapidly as it feeds upon the juices and tissues of the fruit.

### **Mortality in the Larval Stage.**

At the beginning of spring eggs are laid in very small peaches, and a great number of larvae from these eggs never mature, but die in the peach when the food supply is exhausted. As a matter of fact those that do emerge from these small peaches do so prematurely, i. e., before they are full grown. Fig. 3 shows a full-grown larva (enlarged). About the 19th of June when the second brood began first to be captured in large quantities in the jarring operations at Bagley, Ga., in 1909, one of the indications of its presence was the marked predominance in numbers of very small beetles over large ones. Most of the beetles of the first brood were of a uniformly large size, and the presence of so many small beetles among those caught from day to day after the first of June seems to

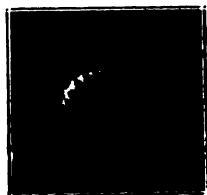


Fig. 3.—Full grown curculio larva. Enlarged (original).

point to the probable fact that most of the initial crop of second brood larvae emerges not fully grown from the peaches. In May the natural drop of peaches occurs, and many that are then infested are so rapidly dried out and hardened by the heat of the

sun that it is impossible for the larva to escape. The peach becomes, to all purposes, a prison in which the worm dies. Small peaches, however, if kept moist and shaded from the sun, will bring larvae to full maturity. The proportion that escapes to enter upon the next phase of its existence is far in excess of that which dies before the larval life is over.



Fig. 4.—Small peaches from which larvae have escaped. (Original.)

The rapid development of the peach itself is apparently often the cause of the death of larvae. Small larvae have frequently been found dead in the channels they had just started to dig, and from the fact that there was present no other apparent cause for their death, comes the belief that they were crushed by the sudden, strong growth of the peach. The development of peaches is not a gradual development; they grow spasmodically—by bounds. During the period while the seed is hardening they practically cease to grow, and then, within a short time, almost double in size. A very small larva just beginning its entrance into the peach would stand little chance of successfully resisting the strong, constant pressure bearing upon it during one of these periods of rapid enlargement.

#### **Length of the Larval Period.**

No definite figures bearing on the length of the egg stage were obtained, but the time the insect inhabits the fruit in the egg and larval states, collectively, was recorded in fourteen instances. These fourteen larvae were all reared from apples, in the following way:



Fig. 5.—The peach on the left shows the destruction worked by a normally matured larva. The point of emergence at the calyx end. On the right is shown a larva at work in the feeding channels of its own making. Natural size (original).

A number of curculios were confined May 19 in a vessel containing four apples, and kept so confined for twenty-four hours, when the apples were removed and placed in separate jars. At the end of the twenty-four hours eggs had been deposited in all four apples. These apples were kept under daily observation and a record kept of the emergences. In the accompanying table may be seen the time, in days, required by each of the fourteen larvæ to emerge:

Time spent as Egg and Larva.

Eggs deposited May 19	Emergence June 13	Emergence June 14	Emergence June 15	Emergence June 16
Apple No. 1.....	1	1	2	0
Apple No. 2.....	0	2	1	0
Apple No. 3.....	1	1	1	1
Apple No. 4.....	0	1	2	0
Total No. of Days	24	25	26	27

The table shows that emergence began on the 24th day after the eggs were deposited and continued daily for four days.

until fourteen larvæ had emerged. No larvæ emerged after the 27th day. Allowing five days in each case for the eggs to hatch, we find two lived as larvæ for nineteen days, five for twenty days, six for twenty-one days and one for twenty-two days. The average time for all is twenty-one days or three weeks.

### The Pupa.

The larva of the plum curculio burrows into the soil immediately after emergence from its host fruit and enters the pupal stage, remaining quiescent until the physical transformations are complete, when the insect, now a perfect beetle, tunnels its way from the earth, and soon thereafter begins feeding upon the available fruit supply.



Fig. 6.—Pupa of the plum curculio. Much enlarged. (After Chittenden.)

### Length of the Pupal Stage.

The fourteen larvæ reared in the above mentioned instances were put into tubes containing moist soil, kept under observation from day to day, and allowed to complete the transformations from larvæ to pupæ and from pupæ to adult beetles. The tubes were opened at both ends and were buried in the soil beneath the shade of a tree. The mouth of the tubes were covered with gauze to prevent the escape of the beetles when they should finally emerge. Only nine of the fourteen ever arrived at the perfect beetle stage, and these came out more or less irregularly. The first emerged on the twenty-second day and the ninth on the thirty-second day.

The accompanying table shows the emergences as they occurred. The average depth to which the larvae went into the soil in the tubes was  $\frac{3}{4}$  of an inch. It is probable that they go deeper than this in the orchard, where the earth is usually harder and more exposed to the heat of the sun.

Time spent in the Soil as Pupa.

No. of Days.....	22	23	24	25	26	27	28	29	30	31	32
Beetles Emerging ..	1	0	1	2	0	1	2	1	0	0	1

A number of beetles not included in the above table were reared from infested windfall peaches, and it was found that the pupal stage varies greatly in length. The average duration

of this phase of the life of the curculio is approximately twenty-five days. No figures were obtained as to the depth which the larva enters the soil to pupate, but it is doubtful if the great majority goes more than two inches. The moisture conditions of the soil doubtless influence this to a large extent. Cultivation of the orchard destroys thousands of pupating beetles, either by directly crushing them to death or exposing them to the attacks of predatory insects and birds.

### The Beetle.

Although the plum curculio greatly damages the fruit crop of Georgia, but few growers have any knowledge of the beetle itself. The habits of the insect in seeking concealment for its feeding and egg laying operations in heavily leafed parts of the tree, as well as the fact that it both feeds and deposits eggs largely at night, make it difficult to find one without careful search. By nature the insect is extremely shy, and will, in the majority of cases, curl up its body and drop from its position on the tree if only slightly disturbed. This habit of "playing possum" makes it easy to catch the offenders by the simple method of jarring them from the tree upon sheets spread out on the ground beneath the limbs.

The beetle has the characteristic appearance of the family to which it belongs. The back is strongly ridged and bears a humped, irregular outline. The proboscis or snout is nearly a third as long as the insect itself. The color is black or dark brown, which is broken by spots of ochre yellow or white, on the wing covers. When disturbed the insect immediately curls up its legs, draws its proboscis below the body and flat against it, and drops from the object upon which it was resting. In this position it closely resembles a small dried bud or piece of tree bark. When the temperature is sufficiently low to chill the insect and render it lethargic, it will often remain in this position, as though dead, for thirty minutes or more. In Fig. 7 is shown a dorsal view of an adult curculio (greatly enlarged), and Fig. 8 shows the insect feeding upon a peach with its head buried in the feeding puncture.



Fig. 7. — Adult plum curculio (*Conotrachelus nenuphar*). Much enlarged. (After Chittenden.)



Fig. 8.—Curculio feeding on peach. Note the feeding punctures in the foreground. Much enlarged (original).

## **EXPERIMENTS WITH ARSENATE OF LEAD AND PYROX FOR THE CONTROL OF CURCULIO.**

Extensive experiments for the control of curculio with arsenical poisons were conducted in Messrs. Berckmans Bros.' orchards at Mayfield, Ga., in 1907 and 1908. The first year's work yielded very marked results, which tended to demonstrate that arsenate of lead might be depended upon largely to reduce the losses resultant upon the attacks of this insect. The work done in 1908 was planned and conducted along parallel lines, but, owing to the small crop of curculio in that section in 1908, the results were not so decisive. Even among the unsprayed trees the percentage of curculio infestation was extremely low, and consequently there could be but little contrast when compared to the treated trees. The experiments that

year netted no results of value, except in so far as they showed the physical effect of the material upon the foliage and fruit. Generally speaking, no differences could be noticed in this particular for the two years. The results of the work done at Mayfield and recorded in this bulletin refer alone to those obtained in 1907.

Two materials were tested in the series, viz.: arsenate of lead and Pyrox. The latter is a manufacturer's product of arsenate of lead and Bordeaux mixture.

### **Injury to Fruit and Foliage from Arsenate of Lead.**

While arsenate of lead has unquestionably succeeded largely in controlling curculio, it is also true that if applied too often or too strong, or if the quality of the material is not of a high order, there results a burning of the leaves, the fruit, and oftentimes the tender wood of the terminal growth. The measure of this burning is determined by the condition of the tree. If weakened from some cause, either from San Jose scale, borers, improper or insufficient cultivation or fertilization, a tree will become partially defoliated from two applications of arsenate of lead more quickly and to a greater extent than would a vigorous, healthy, strongly growing tree from four applications.

The evidences of burning appear first on the leaves, later on the fruit, and if severe, even on the wood which is making the buds for the next year. The injury upon the leaves usually takes the form of a yellowing thereof, just as they change color prior to shedding off in the fall. This change of color is followed almost immediately by the dropping of the leaves. Another form of the injury, though appearing much more infrequently, is the shot-holing of the foliage and the searing of the leaves.

The injury to the fruit shows itself in small, depressed, blackened, burnt areas on the surface. These areas rapidly enlarge, often resulting in the peach splitting open and the formation of masses of gum which exude from the wound. A slight burn does not necessarily mean the loss of the fruit, as peaches sprayed properly with arsenate of lead attain a brilliancy of color rarely equalled by unsprayed peaches, and more than enough to offset the depreciation caused by a slight burn. It must be understood that sun-scalding of fruit is caused by one

of the three causes named above, or by a combination of these causes. It has been clearly shown that a first-class grade of arsenate of lead can be used upon vigorous, thrifty trees as many as four times in a season, and there will be no harmful effects from it. On the other hand, the grower should use his judgment with reference to the condition of his trees. If they are weak or in poor foliage they should not be sprayed more than twice.

With no consideration for the saving of fruit from curculio, it is almost worth while spraying with arsenate of lead solely for the sake of the beautiful color it adds to the peach. The market value of peaches is appreciably enhanced by the attainment of this feature alone.

### **PLAN OF EXPERIMENTS.**

Two varieties of peaches were treated, Elbertas and Hileys, but a late freeze killed the Hileys after they had been once sprayed, and this variety was necessarily dropped.

The sprayed plats embraced sixty or more trees each, and a check or unsprayed plat of a hundred trees was left for purposes of comparison. There were seven sprayed plats, totalling 600 trees. All the plats in the test were situated near a body of woods in order to subject them to a maximum probability of infestation from overwintering curculio sheltered by the woods.

In each plat one tree in every fifteen was selected as representing the average condition over the entire area. The wind-falls from these selected trees were gathered up at intervals throughout the season and sliced into small pieces. All fruit so opened was classified under two heads: those showing the presence of curculio larvæ and those free of infestation. A record was kept of the sound and of the "wormy" fruit. In this way it was possible to estimate the exact percentage of each kind at the end of the season, when the entire crop from these trees had been gathered and opened.

### **Arsenate of Lead.**

Four plats were treated with this material, and the number of sprayings applied ranged from two to four. The material was used at a proportion of two pounds to fifty gallons of water.

Into this diluted mixture was incorporated a milk of lime solution made from three pounds of good stone lime. Care was taken to "work up" the lead thoroughly. This operation requires thoroughness. In order to have it well mixed with the water it should first be stirred in a bucket or open vessel with a small amount of water, the water drained off slowly into the spray barrel, more water mixed with the paste-like mass remaining in the vessel and again drained off as before until all the arsenate of lead is fully and finely divided. The milk of lime solution was made by slaking three pounds of stone lime and working the lime solution through a strainer into the spray barrel by the same process followed in mixing the arsenate of lead. After the arsenate of lead and the lime mixture were poured into the spray barrel, the latter was filled with clear water, and the diluted spray material was ready for use.

As both lime and arsenate of lead rapidly settle out of the water unless well agitated, a pump with a good agitator should always be used in spraying with this material. The heavier-than-water material is better kept in suspension if stirred occasionally from the bottom of the barrel with a paddle.

The original plan called for the first spraying to be applied immediately after the petals had fallen, the succeeding applications to be applied at intervals of ten days or two weeks. This plan was adhered to throughout the series except when rain made it necessary to postpone the sprayings.

The results obtained in each plat are given below in tabulated form. The tables show the percentage of infestation of every plat. Comparison of these figures with those obtained from the check plat will leave no doubt of the effectiveness of the lead in holding curculio in check.

#### **What Arsenate of Lead Accomplished in 1907.**

Plat 1. This plat was sprayed twice, the first spraying being applied April 2nd, and the second April 11th, or nine days later. The peaches from the selected trees representing this plat are taken together and averaged.

Plat 1. Arsenate of Lead. 2-3-50 Formula.

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 1, 4 trees .....	503	1056	32	68
Check plat, 7 trees....	1468	687	68	32

There was only a very slight defoliation of the trees of this plat, and the fruit was well colored and comparatively free of blemishes from curculio feeding punctures. Reference to the table will show that there was 36% more peaches free of curculio in plat 1 than in the check plat.

Plat 2. This plat received three treatments, the first on April 2nd; the second on April 11th and the last on April 19th. As in plat 1, the fruit from the four selected trees is added together in the table and the average taken.

Plat 2. Arsenate of Lead. 2-3-50 Formula.

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 2, 4 trees .....	611	1426	30	70
Check plat, 7 trees....	1468	687	68	32

Only thirty per cent. of the entire crop from plat 2 was worm-infested, or, for approximately the same number of peaches in each of the plats included in the table, there was 38% more wormy fruit in the unsprayed check plat than in plat 2, thrice sprayed with arsenate of lead.

The peaches in plat 2 were highly colored and free of sun-scalds. The defoliation, although a trifle greater than that in plat 2, was nevertheless more beneficial than otherwise. The leaves began to drop slightly about the time the third treatment was applied, but they had practically ceased to shed by the fifteenth of May.

Plat 3. Plat 3 was sprayed four times. The first application was made April 2, the three remaining treatments being applied on April 11, 17 and 25, respectively. A fourth part of this same plat was given two additional sprayings, the first on May 3rd and the last on May 10th, making a total of six sprayings for the one-fourth part. Plat 3, proper, is represented by the fruit from three trees in the table, which is taken together and averaged.

**Plat 3. Arsenate of Lead. 2-3-50 Formula.**

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 3, 3 trees .....	340	993	25	75
Check, 7 trees .....	1468	687	68	32

The difference here between the percentage of infested fruit in the check plat and that in plat 3 is 43%. This is the highest percentage of sound fruit gathered from any plat so far considered.

About one-third of the foliage shed off the trees of this plat and there was some sun-scalding of the fruit. The injury from this, however, was very small. The peaches over the whole plat were deeply and beautifully colored.

Plat 4. This plat is simply a one-fourth part of plat 3 sprayed twice more. The fifth application was applied on May 3rd, and the sixth and last, one week later, on May 10th. Two trees were selected as representative trees. The fruit from these totalled 969 peaches, infested as set forth in the following table:

**Plat 4. Arsenate of Lead. 2-3-50 Formula.**

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 4, 2 trees .....	237	782	24.5	75.5
Check, 7 trees .....	1468	687	68	32

It will be noted that only .5% more peaches were worm-free in this plat than in plat 3, although it received two more sprayings.

The fruit on this plat, although brilliantly colored, was considerably damaged from sun-scald. A great number of peaches were thereby rendered unmarketable. The trees, also, were heavily defoliated, and the effect of the material on the newly formed buds was disastrous, and noticeably reduced the yield of peaches the following year. It is doubtful if any tree, no matter how vigorous, would not be injured if sprayed as many as six times.

The peaches on all the plats in the work with arsenate of lead were very highly and beautifully colored, gaining superficial attractiveness as well as comparative freedom from curculio.

## PYROX.

Pyrox, a mixture of arsenate of lead and Bordeaux mixture, is manufactured by the Bowker Insecticide Co., Boston, Mass., and recommended to be used at a proportion of five pounds to fifty gallons of water. It was used at Mayfield according to the above directions, without the addition of lime.

The experimental work with this material was done alongside of that conducted with arsenate of lead and in plats of equal size as the arsenate of lead plats. There were only three plats sprayed, these being treated on the same days that the lead sprayings were applied. Plat 1 was sprayed three times, plat 2 four times and plat 3 (a one-fourth part of plat 2) was treated with two additional sprayings and corresponds to plat 4, arsenate of lead.

The results of these sprayings were obtained in the manner already outlined, and are recorded in tabulated form below :

Plat 1. Pyrox. Sprayed 3 times. 5-50 Formula.

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Plat 1, 4 trees .....	192	545	25	75
Check, 7 trees .....	1468	687	68	32

Plat 2. Pyrox. Sprayed 4 times. 5-50 Formula.

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Plat 2, 2 trees .....	131	389	25	75
Check, 7 trees .....	1468	687	68	32

Plat 3. Pyrox. Sprayed 6 times. 5-50 Formula.

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Plat 3, 2 trees .....	115	541	17.5	82.5
Check, 7 trees .....	1468	687	68	32

Plat 1 is the only one of the above that did not show injury from the treatment. Plat 2, sprayed four times, was considerably defoliated and the fruit was damaged slightly from sunscald. Plat 3, a one-fourth part of plat 2, and sprayed six times, lost over a half of its crop of foliage and quantities of the fruit was so badly burned that it was unfit for anything.

Pyrox is intended as a combined insecticide and fungicide for the control of curculio and brown rot. One of its constitu-

ents is Bordeaux mixture, and it is this element of the compound that acts as a fungicide. As there are superior and more certain means of controlling brown rot (treated of elsewhere in this bulletin), and as Pyrox is too drastic a treatment at the strength recommended by its manufacturers, it is inadvisable to use it, except, possibly, at a reduced strength.

Pyrox, like arsenate of lead, has the power to paint peaches in gorgeous colors and to gain for them comparative immunity from infestation from curculio. However, because of its drastic effect on fruit and foliage it is not recommended.

### **Arsenate of Lead Experiments in 1909.**

The experiments at Bagley, Ga., in 1909 were worked out along parallel lines to those conducted at Mayfield in 1907. There were certain marked differences in the results, however, occasioned by various causes, and these differences are mentioned and explanations offered for them.

In the first place the putting-out of foliage in the orchard under treatment presented very unusual conditions in 1909. Although the trees bloomed and shed their blooms about the normal time, the leaves were extremely slow in making their appearance. As late as the 22nd of April the trees were almost devoid of leaves, although young leaves were beginning to push out, promising a full crop of foliage ultimately. At this time the peaches were about the size of a thimble and had completely shed their calyces or "shucks." Two applications of arsenate of lead had been applied to these slightly protected peaches by the date mentioned, and it is to the slow growth of foliage and the consequent long exposure of the fruit, as well as to the action of arsenate of lead, that much of the injury resulting in two of the sprayed plats is ascribed. Many of the trees had been weakened materially by the San Jose scale. These trees were naturally more susceptible to injury than the more vigorous, scale-free trees.

The plan of the work was much the same as that outlined in the Mayfield experiments, except that one plat was sprayed with three pounds of arsenate of lead to fifty gallons of water, and that the sprayings were applied at longer intervals. Also the plats were larger, and more trees were selected from them

as representative trees. The records were kept in identically the same way, and the figures show the exact percentage of the two classes of fruit yielded by the trees.

The following tables and paragraphs give the number of sprayings to each plat, with the results obtained, etc.:

**Plat 1.** Plat 1 was first sprayed on April 2nd. Three pounds of arsenate of lead were used with fifty gallons of water, without the addition of milk of lime. This formula was used with each of the three applications, which were applied at intervals of three weeks. The second treatment was applied on April 22nd, and the third and last was applied May 14th. At this time there was very little of the material showing on the leaves from the first two applications, there having been only a few leaves present, but the young peaches were well coated. The trees were heavily leafed and required nearly twice as much spray material to cover them well as the first application required.

The following table gives the percentages of infested and uninfested peaches gathered from the nine trees representing this plat.

**Plat 1. Arsenate of Lead. Sprayed 3 times. 3-50 Formula.**

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Plat 1, 9 trees .....	24	3958	8	92
Check, 10 trees .....	978	622	59.5	41.5

The number of wormy peaches for the entire nine trees as recorded is only eight per cent. of the entire product. This is a remarkably low figure and represents 51.5% more freedom from curculio than the check plat.

But however much the peaches were protected in this particular they were injured severely in another. By the first of July the trees were heavily defoliated, the peaches everywhere sun-scalded and disfigured, and some were beginning to drop from the trees. Many fine, highly colored peaches were gathered from this plat, and a considerable number was too lightly burned to be a total loss at the packing shed. Yet, of the 1,218 peaches gathered on and after July 6th (the ripening period), 520 or 42% were too badly cracked and sun-scalded to be classed as anything else than culls.



Fig. 9.—Peaches showing injury from arsenate of lead. The peach on the right is an extreme case; that on the left is more typical and better shows how the fruit sometimes splits when nearing maturity. Natural size (original).

The injury did not stop with the ruin of the peaches, for the wood growth of 1909 was killed out noticeably in places, and more was injured. These burned areas on the wood bore the characteristic reddish, discolored splotches on the bark.

When the last examination of these trees was made on July 21st, it was apparent that many of the newly formed buds had been killed.

It must be borne in mind in considering the above figures and conditions that this plat was treated at a considerably increased strength of material and without the influence of the lime to modify the burning effect of the lead; also that the trees were not as vigorous as they might have been and that they were very tardy in producing their full crop of foliage.

Plat 2. This plat was sprayed but once, arsenate of lead being used at the proportion of two pounds to fifty gallons of water, with the standard solution of milk of lime made from three pounds of lime.

This single spraying was made April 9th. Although there was less than one-fourth part of the normal crop of foliage at this date, the peaches were well developed and had shed most of their "shucks."

The peaches from the nine trees representing this plat were classified as shown in the accompanying table:

Plat 2. Sprayed once with arsenate of lead. 2-3-50 Formula.

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 2, 9 trees .....	802	2131	29	71
Check, 10 trees .....	978	622	59.5	41.5

It will be seen from the figures that even this single spraying was productive of good results. As against 59.5% of wormy peaches in the check plat, only 29% were infested in plat 2. The coloring of the peaches was better than that in the check plat, and there was no injury whatever.

Plat 3. Two applications of arsenate of lead were made to plat 3, the first on April 10th and the second on April 28th, nearly three weeks later. The standard 2-3-50 formula was used. Results were as follows:

**Plat 3. Sprayed twice with arsenate of lead. 2-3-50 Formula.**

	No. of infested peaches	No. of uninfested peaches	Per cent. of infested peaches	Per cent. of uninfested peaches
Plat 3, 9 trees .....	739	3260	18	82
Check, 10 trees .....	978	622	59.5	41.5

By the 15th of June the peaches in this plat had begun to turn reddish in color while those in the check plat were yet absolutely green. They ultimately produced a high color and ripened somewhat in advance of the unsprayed peaches.

The shedding of foliage was very slight, and was more beneficial than otherwise. There was no sun-scalded fruit in evidence, even on weakened and dying trees. The treatment of this plat yielded splendid results from every standpoint. Only 18% of the entire crop of peaches set by the trees was worm infested.

**Plat 4.** Plat 4 was sprayed three times with arsenate of lead at the 2-3-50 formula. By reason of the unprecedented manner in which the trees leafed out, it was decided to defer the initial spraying on one plat until the trees should be in fuller foliage. Therefore, the first spraying of plat 4 was not made until April 12th, and even then the trees were as bare of leaves as they would ordinarily be three weeks earlier in the season. When the second spraying was applied April 29th, the trees were in much better foliage, requiring much more material per tree to spray them than was required for the first spraying, but even at this late date the full leaf crop had not made its growth. The third and last application was made May 14th. From the nine selected trees of this plat the peaches were gathered and classified as follows:

**Plat 4. Sprayed 3 times with arsenate of lead. 2-3-50 Formula.**

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Plat 4, 9 trees .....	582	1714	25.5	74.5
Check, 10 trees .....	978	622	59.5	41.5

The fact that there is 7.5% more curculio infestation in this plat than in plat 5, sprayed twice, is accounted for on the grounds that plat 4 immediately adjoined the unsprayed section of the orchard, while plat 3 was no nearer to it than nine rows of sprayed trees.

By the 15th of June the shedding of the leaves was practically over, with less than one-third of the entire leaf crop affected. It was then evident that there would be some burning of the fruit. By the 3rd of July the peaches that were badly sun-scalded had commenced to drop, all the peaches thus affected ripened prematurely.

Of the 624 peaches gathered from the selected trees of this plat from July 6th until the entire crop was harvested, 209 or 33.5% were sun-scalded and cracked. This number, however, includes all peaches showing evidences of sun scald in any degree. Perhaps half of them were sufficiently sound to be packed and shipped.

The injury to the fruit in this instance was accompanied by a proportionate injury to the tender wood growth of the season. Although not so great as that described in plat 1, it is nevertheless worthy of mention. Under the conditions existing in the orchard in 1909, the treatment was obviously too drastic.

In Part II of this publication is shown the effects of a greater number of sprayings of arsenate of lead, and it will be seen from these that there was no deterioration of the fruit and no injury to the trees. It is well to recall at the same time that four sprayings in 1907 worked far less havoc than that cited in plat 3, now being considered. All of which goes far to prove that the condition of the trees determined directly the degree of defoliation as well as the injury to the fruit.

## **HOW DOES ARSENATE OF LEAD AFFECT CURCULIO?**

An effort was made at Bagley, Ga., to determine whether arsenate of lead acts merely as a repellant or as a fatal poison to curculio. For this purpose a frame large enough to fit over a small tree was constructed and covered with gauze wire, 16 meshes to the inch. This cage is shown in the accompanying figure. It was intended to confine curculios in this cage, leaving, as their only food supply, the leaves and fruit of the tree, which was to be previously drenched with arsenate of lead.

Accordingly on May 10th the tree was literally soaked with a solution of arsenate of lead at 3 lbs. to fifty gallons of water,



**Fig. 10.—Cage in which curculios were confined with an arsenically poisoned food supply (original).**

the spray allowed to dry and the drenching repeated. On the 11th of May 372 curculios, which had been confined for forty-eight hours without food, were released into the cage which had been fitted over the tree subsequent to the spraying of the latter. The cage was set upon a white cloth spread beneath the limbs of the tree in order that any curculios that might eat the poisoned bait and die therefrom could easily be seen when they fell upon the white cloth.

This tree was closely watched for ten days but not once was a curculio discovered feeding on any part of the tree. Of the eight unpunctured peaches that the tree originally bore, only six were finally punctured with a total of eight punctures. These were very small punctures, scarcely breaking the skin of the peach. No eggs were laid in these cavities.

The curculios, for the most part, seemed to have the strongest aversion to the tree, and their lives were spent in trying to escape from it through the wire gauze. Some few smaller beetles did escape in this way, and at the end of ten days there was not a single live curculio within the confines of the cage.

Arsenate of lead unquestionably kills curculios when they assimilate it in feeding actively, but in the above instance it acted more as a repellant, there being no part of the foliage or fruit, however small, which was not well coated with the poison.

### **JARRING FOR CURCULIO.**

A block of Elberta peach trees embracing twelve hundred trees was jarred at Bagley, Ga., in 1909, for the sake of determining the absolute value of jarring for the control of curculio, as well as its comparative value as opposed to liquid spraying. It was planned to jar the plat every two days, but labor conditions were such that it was not possible to follow the original plan. Although the jarring was carried out irregularly, the results are of interest as showing the direct influence which the close proximity of timbered land has upon the orchard from the standpoint of curculio infestation.

The block of trees selected for the jarring operations was forty rows long and extended thirty rows into the orchard. It lay parallel to the woods and was separated from it only by the width of a farm road.



Fig. 11.—Showing outfit and operators used in jarring for curculio (original).

## Jarring Equipment.

The equipment used in the work consisted of two canvas covered wooden frames, each four and one-half by nine feet, and a leather-padded maul for jarring the trees. The maul was fitted with a handle five feet long. Fig. 11 shows the style of frames employed and the "gang" at work. This outfit can be operated by five people. Usually four women were employed to carry and place the sheets, two to each sheet, and one man to carry the heavy, padded maul and jar the trees.

### Method followed in Jarring and Determination of Results.

Beginning with the row nearest the woods (row No. 1) each row was jarred as quickly as possible, the sheets spread upon the ground at the end of the row and the beetles picked from them by hand, counted and placed in bottles. Counting the "catch" from each row separately, it was possible to obtain the exact number caught per row for the season.

Jarring was first begun March 27th and continued at more or less irregular intervals until June 11th. The operation was begun as early in the morning as it was possible to see, and continued until the heat of the sun caused the curculios to become active immediately after they were jarred to the sheets. The weather was cool during the first days of the operations and it was possible to jar the full rows of forty trees without making an intermediate gathering of the harvest; but later in the season no more than 20 trees could be jarred before it was necessary to gather up the captured beetles to prevent their escape. Beetles have often been observed to fly from the sheets as early as 5.10 a. m. during May and June, and in these months it is practically useless to jar after 6.30 unless the beetles are taken from the sheets every fifteen or twenty trees.

In the following table, beginning with row 1, nearest the woods, to row 30, farthest from them, the number of trees in each row, the number of beetles per row and the percentage of beetles per tree, are given. It is interesting to note the gradual reduction in the number caught from each row, as we move away from the woods.

Row	No. of trees	No. of beetles	No. of beetles per tree
1	28	806	31
2	28	739	26.4
3	32	682	21.3
4	35	627	18.9
5	30	497	16.5
6	36	477	13.2
7	33	709	21.5
8	35	573	16.4
9	33	619	18.7
10	32	590	18.4
11	33	476	14.4
12	30	589	19.6
13	32	493	15.4
14	34	357	10.5
15	31	271	8.7
16	30	241	8
17	34	323	9.5
18	36	284	8
19	30	179	6
20	32	268	8.4
21	36	268	7.4
22	36	275	7.6
23	32	229	7.1
24	35	211	6
25	37	197	5.6
26	35	178	5
27	39	112	4.1
28	34	95	3.4
29	26	101	3.4
30	33	161	5.3
Totals	985	11,626	11.8

The percentage of infested and uninfested fruit was reckoned just as it was in the sprayed plats, i. e., by opening all the wind-falls and the ripe peaches and classifying them as they properly belonged. Ten trees were selected from the block for this purpose, and eight trees were selected from the nearby section of the orchard for the check plat.

The percentages of the two kinds of fruit yielded by the jarred plat and its check plat are given in the following table:

	No. of peaches infested	No. of peaches uninfested	Per cent. of peaches infested	Per cent. of peaches uninfested
Jarred plat, 10 trees ..	1739	2599	40	60
Check plat, 8 trees ...	1664	851	34	66

Comparison of the figures in the third column shows that only 6% more peaches were uninfested in the jarred plat than

in the untreated check plat. This is a poor showing considering the large number of beetles caught from the trees in the jarred plat.

### **Spraying vs. Jarring.**

When jarring is compared to spraying on any basis, it suffers by the comparison. The heavy cost involved in the operation of a sufficient jarring force, its comparative ineffectiveness and the brevity of the season at which effective jarring can be done, unite to make it inferior. Unless labor is abundant and cheap, the cost of jarring for even two hours in the early morning is decidedly disproportionate to the good accomplished. It is impracticable from an economic standpoint and inefficient as a remedial measure. In small orchards, and under conditions which permit the control of the labor side of the question, it would be feasible. In large orchards jarring presents too many serious obstacles for successful manipulation.

### **METHODS OF CONTROL.**

The results of the two years' experiments discussed in this bulletin show that curculio can be controlled largely by arsenate of lead at a ratio of 2 lbs. to 50 gallons of water, to which is added a milk of lime solution made from 3 lbs. of stone lime. Two applications are recommended, the first to be applied as the calyces or shucks are shedding, and the second two weeks later. In thrifty, healthy orchards where the foliage growth is dense, three applications are recommended. *It is unsafe to spray weak trees more than twice.*

Curculio and its relation to brown rot are discussed in Part II of this bulletin. The two are intimately associated; in proportion as the one is active, the other is in evidence. It is hoped that the reader will see how the control of curculio will not only reduce the number of "wormy" and punctured peaches, but proportionately eliminate brown rot as well.



## PART II

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# BROWN ROT EXPERIMENTS IN 1909.

By

A. C. LEWIS.

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### INTRODUCTION.

All peach growers are more or less familiar with brown rot, and a detailed description of the disease is not necessary. Many growers know from dear experience how it may cut down the yield and profit from their orchards; and many more know how in some seasons the peaches rot in transit.

The loss from brown rot varies at different seasons, the severity of the disease depending upon the weather and the number of curculio present. The loss from brown rot is frequently 25% to 50%, and sometimes as high as 95%, of the crop in some localities.

We have not, heretofore, been able to advise any satisfactory treatment for brown rot. With the promising results thus far obtained from the experiments that have been conducted in Georgia, and from the commercial tests made, it now seems that we will be able to control brown rot and curculio by the self-boiled lime-sulphur and arsenate of lead.

### EARLY EXPERIMENTS.

For a number of years many experiments have been carried on at different places in the United States to determine whether brown rot of peaches could be controlled by spraying with Bordeaux mixture. The Georgia State Board of Entomology experimented with the Bordeaux mixture three different seasons. From these experiments it was concluded that brown rot of peaches could not be successfully controlled with the Bor-

deaux mixture. Others experimenting also arrived at the same conclusion.

In 1907 brown rot experiments were begun by Prof. W. M. Scott of the Bureau of Plant Industry, U. S. Department of Agriculture, with the self-boiled lime-sulphur solution. The results of the first season's work were very promising. In 1908 and 1909 Mr. W. T. Ayres, under the direction of Prof. W. M. Scott, carried on extensive experiments with the self-boiled lime-sulphur in Georgia with very satisfactory results. For Prof. Scott's report upon the experiments of 1908, see Circular No. 1 of the Bureau of Plant Industry, U. S. Department of Agriculture.

In Prof. Scott's experiments it was found that curculio sometimes made it very difficult to control brown rot. The observations of the writers in Georgia have been that when curculio was abundant brown rot was more severe, if the weather conditions were favorable, than when the curculio was not so abundant.

Experiments conducted by the Georgia State Board of Entomology for the last three years, have shown that the curculio can be controlled to a large extent by spraying with arsenate of lead. For a complete report upon these experiments up to and including 1909, see the first part of this bulletin.

Previous to 1909 it was not considered safe to combine the two remedies, arsenate of lead and the self-boiled lime-sulphur solution, for it was not known just what the results would be. It was cited that in many cases arsenate of lead alone was injurious to the fruit, and it was feared that if the two mixtures were combined the injury to the fruit might be still greater.

### **PLAN OF EXPERIMENTS.**

In planning the experiments for 1909 we decided, first, to compare the self-boiled lime-sulphur mixture with the self-boiled lime-sulphur and arsenate of lead; second, to test the concentrated lime-sulphur and the Bordeaux mixture.

#### **Different Materials Tested.**

The following different materials were tested:

1. Self-boiled lime-sulphur and arsenate of lead (8-8-2-50).
2. Self-boiled lime-sulphur (8-8-50).

3. Bordeaux mixture and arsenate of lead.
4. Bordeaux mixture (3-6-50).
5. Lime-sulphur boiled (10-15-50), diluted 1 gallon to 25 gallons of water.
6. Same as above + 2 lbs. arsenate of lead to 50 gallons of water.
7. Lime-sulphur boiled (10-15-50), diluted 1 gallon to 50 gallons of water.
8. Same as above + 2 lbs. arsenate of lead to 50 gallons of water.
9. Lime-sulphur solution prepared (Grasselli Co.), 1 gallon to 50 gallons of water.
10. Same as above + 2 lbs. arsenate of lead to 50 gallons of water.
11. Prepared lime-sulphur solution, diluted 1 gallon to 75 gallons of water.
12. Pratt's Sulfocide, 1 gallon to 75 gallons of water.
13. Same as above + 2 lbs. arsenate of lead to 50 gallons of water.
14. Prepared lime-sulphur, 1 gallon to 75 gallons of water.
15. Pratt's Sulfocide, 1 gallon to 100 gallons of water.

### **Condition of the Orchard.**

These experiments were carried on in Betts Bros.' orchard at Woodbury, Ga. The orchard is located on Pine Mountain ridge, at an elevation of 900 to 1100 feet. The trees were 6 to 7 years old. In 1908 from 50% to 75% of the fruit was lost from brown rot and curculio. In the winter of 1908 the orchard was sprayed with the home-made lime-sulphur solution for the San Jose scale. In the spring the trees received a heavy application of commercial fertilizer, and during the season of 1909 made a rapid growth. In 1908 no effort was made to pick up the fallen fruit or gather the mummied peaches. From this it will be seen that the conditions were ideal for curculio and brown rot.

### **Time of Application of the Different Sprayings.**

It was the intention to spray three times with the different materials, but on account of injury to the leaves and fruit some of the plats were only sprayed twice.

It may be well to mention here that before we made the first application of lime-sulphur the trees were sprayed with arsenate of lead (2-3-50), between March 26th and 31st. That is, the whole orchard was sprayed except the three check plats mentioned further on in this report.

The first application for the control of brown rot and curculio

was made April 15th (as the calyces or shucks were shedding); the second May 11th and 12th; the third June 10th and 11th.

## **RESULTS SECURED.**

### **Solutions that Injured the Fruit and Foliage of the Trees.**

The following solutions injured the fruit and foliage when used with or without the arsenate of lead, and were only applied twice: Bordeaux Mixture (3-6-50), lime-sulphur mixture (10-15-50), boiled, diluted 1 to 25 and 1 to 50; lime-sulphur mixture prepared (Grasselli Co.), diluted 1 to 25, 1 to 50 and 1 to 75; Pratt's Sulfocide diluted 1 to 50, 1 to 75 and 1 to 100.

Soon after the second application of the above materials the leaves began to drop off, and in some cases the fruit. For this reason no attempt was made to keep the picking records on the plats where these different materials were used. At picking time it was noticed that the fruit on the trees sprayed with the solutions mentioned above did not ripen properly. Where arsenate of lead was used the fruit was hard and of a deep red color, and was not considered salable.

### **The Self-Boiled Lime-Sulphur Mixture.**

The results secured with the self-boiled lime-sulphur, and the self-boiled lime-sulphur and arsenate of lead mixture, are well shown in the following table:

Plat No.	Sprayed three times	Variety	% Stung by Curculio	% of Brown Rot	% of Scab	% of Sound	Remarks
1	Self-boiled lime-sulphur. 2 lbs. arsenate of lead to 50 gals. water.	Elberta	16.72	3.46	Less than 1	81	
2	Same as above without arsenate of lead.	Elberta	49.23	9.2	Less than 1	42	It was the curculio that reduced the % of sound peaches.
Check plat A	Not sprayed.	Elberta	66.4	32.2	50.3	32	
Check plat B	Not sprayed.	Elberta	50.65	35.39	71.7	34	Peaches with only a little scab were considered sound.
1	Self-boiled lime-sulphur. 2 lbs. arsenate of lead to 50 gals. water.	Belle of Georgia	9	2.44		91	
2	Same as above without arsenate of lead.	Belle of Georgia	13.3	3		87	Sprayed once with arsenate of lead March 31st.
Check	Not sprayed.	Belle of Georgia	32.85	18		55	
Orchard	*See foot note below.	Elberta	10 to 15	10 to 12	1	85	Per cent determined by counting the peaches at the pack'g house from time to time did not include fallen fruit nor all the fruit picked from trees.

\*Whole orchard was sprayed twice with self-boiled lime-sulphur and arsenate of lead (lime 8 lbs., sulphur 8 lbs. to 50 gallons of water) and once (first spraying) with arsenate of lead and lime (2-3-50).

### Size of Plats.

In these experiments each plat contained from 50 to 68 trees. The results as given in the above table were determined by actually counting all the peaches from each plat that were

picked from the trees and those that fell on the ground, after picking was begun. No account was kept of the early wind-falls.

The plats were situated on one side of the orchard near the woods, and in the part of the orchard that was affected the most the season before with curculio and brown rot. It must also be remembered the whole orchard was sprayed as previously mentioned.

### **SOME NOTES ON THE RESULTS.**

The above table shows, in a graphic way, how successfully the brown rot and curculio were controlled. By comparing the results in Plats No. 1 and No. 2, it will be seen that much better results were secured with the self-boiled lime-sulphur and arsenate of lead mixture, than with the self-boiled lime-sulphur alone. It will be noticed the scab or black spot was reduced to less than 1 per cent. This alone in some years would pay for spraying. The difference between a sprayed and unsprayed peach in this respect is well shown in Fig. 1. When the peaches from the unsprayed trees were brought to the packing house they were so specked and looked so inferior when compared with the sprayed peaches, that they were not put in the same car, but packed by themselves and shipped by express to the local markets.

### **Injury to Tree and Fruit.**

The self-boiled lime-sulphur did not injure in the least the leaves or the fruit. The self-boiled lime-sulphur and arsenate of lead only shot-holed a few leaves, and *did not* hurt the fruit.

The results in the orchard spraying compare very favorably with the results in the experimental plats, both as to control of brown rot and curculio and effect upon the trees and fruit. The whole orchard, as mentioned before, was sprayed once with arsenate of lead and lime, and twice with self-boiled lime-sulphur and arsenate of lead. Where treated this way no damage was done to the leaves or fruit, except on a few trees that were much weakened by the borers and San Jose scale.

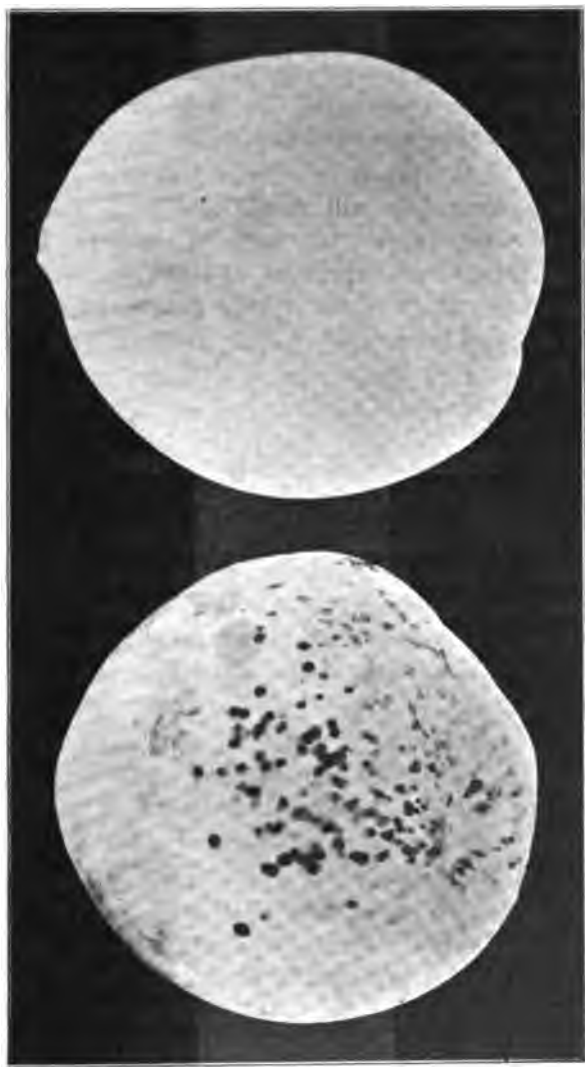


Fig. 1.—Showing difference between a sprayed and an unsprayed peach. The sprayed peach is without a blemish; the other shows the familiar spotting of peach scab. Somewhat reduced (original).

In one part of the orchard the curculio was very abundant even after two sprayings, once with arsenate of lead and lime (2-3-50), and once with self-boiled lime-sulphur and arsenate of lead, so that part of the orchard was sprayed once more.

In this spraying 3 lbs. of arsenate of lead was used to 50

gallons of water without lime. The results of this spraying were very disastrous. Over 50 per cent. of the leaves dropped and 25 per cent. of the peaches were burned, and the remainder of the fruit was much damaged. The fruit on these trees never ripened properly, but was hard and highly colored.

The injury to the peach by arsenate of lead takes a very characteristic form. It will first begin as a small, round, brownish-red burnt place. In course of time this burnt area will become larger and depressed, and the rest of the peach will be dark red. Many of the injured peaches crack open, the gum oozes out and the peaches will be in a condition like those shown in Fig. 9 (Part 1).

### COMMERCIAL TESTS IN 1909.

In 1909 Mr. J. J. Stranahan sprayed his entire orchard, once with arsenate of lead and lime and twice with the self-boiled lime-sulphur and arsenate of lead, with very good results. Mr. Ward, whose orchard is near Mr. Stranahan's, sprayed his orchard twice with arsenate of lead and lime, with very satisfactory results.

Mr. Betts, as previously mentioned, sprayed with arsenate of lead and the self-boiled lime-sulphur with very gratifying results, except where he sprayed the third time with 3 lbs. of arsenate of lead to 50 gallons of water.

Profs. W. M. Scott and W. T. Ayres in their experiments for the control of brown rot at Fort Valley, Ga., in 1909, sprayed 1100 trees as follows: "First, on March 31st (as the calyces were shedding), with arsenate of lead 2 lbs. to 50 gallons of water; second, on April 22nd with 8-8-50 self-boiled lime-sulphur and 2 lbs. arsenate of lead; third, on May 21st with self-boiled lime-sulphur alone; fourth, on June 9th with self-boiled lime-sulphur."

"When assorted and counted the fruit from five trees had only 4½% affected with brown rot, about half of which was caused by curculio. Only 6½% of the fruit showed scab marks, and these were mostly small inconspicuous specks. The curculio infestation was 27½%."

For a detailed report of Prof. Scott's experiments, see page 96 of Bulletin No. 30, Georgia State Board of Entomology, "Proceedings of the Georgia State Horticultural Society for 1909."

### **LOSS OF CROP PREVENTED BY SPRAYING.**

The gain from spraying is greater than the difference in the percentage of sound fruit on unsprayed and sprayed trees. To illustrate how much greater the yield of fruit is on sprayed than unsprayed trees, we give the following figures: On 53 unsprayed trees the total number of peaches was 304; on 54 trees, sprayed once with arsenate of lead and three times with the self-boiled lime-sulphur, the total number of peaches was 782; and 68 trees sprayed once with arsenate of lead and three times with self-boiled lime-sulphur and arsenate of lead, yielded 1154 peaches.

To compare with the above we need only to give the yield in an orchard near Mr. Betts that was not sprayed. The crop was light in this orchard but the owner thought he would have five cars of peaches. He shipped one car and about half of another; the rest of the peaches were lost on account of the curculio and brown rot. There were other growers in the State that had the same experience last summer.

### **CARRYING QUALITY OF THE FRUIT.**

Another factor worthy of consideration is the increased carrying quality of the sprayed fruit. The firm that bought Mr. Betts' peaches put them in cold storage. When the peaches were all picked Mr. Betts went to New York and saw some of the peaches that had been in cold storage for 8 or 10 days. He made no exact count of the peaches to determine what per cent. was affected with brown rot. Mr. Betts and the commission men were well pleased with the results.

## SHIPPING TEST MADE BY W. M. SCOTT AND W. T. AYRES.

In the experiments conducted at Fort Valley, Ga., by Profs. W. M. Scott and W. T. Ayres, a shipping test was made. Their report on this shipping test was as follows:

"In order to determine the difference in the carrying quality of the sprayed and unsprayed fruit, two test cars of peaches from the experiment plats were shipped to New York, examined on arrival and sold in the usual way through a commission house. The fruit in the first car was picked on Friday, July 9th, in the rain, and although due on the market Tuesday morning was delayed en route, and was not sold until Wednesday morning. The market was almost glutted with poor fruit and the prices ranged low. The test car contained Elbertas and Belles—sprayed and unsprayed. The sprayed Elbertas from the lime-sulphur arsenate of lead block sold for \$2.00 a crate, and the unsprayed Elbertas from the adjacent unsprayed block sold for \$1.50 a crate, making a difference of 50 cents a crate. The sprayed Belles sold for \$1.25 a crate and unsprayed Belles for \$1.12. An examination of the Elbertas showed that 34 per cent. of the unsprayed fruit was specked with brown rot, while only 6 per cent. of the sprayed fruit was affected.

"The second car arrived Wednesday night, and was sold Thursday morning, July 15th, at the following prices:

Sprayed Elbertas at .....	\$1.45 per crate.
Unsprayed Elbertas at .....	1.25 per crate.
Sprayed Belles at .....	1.50 per crate.
Unsprayed Belles at .....	1.14 per crate.

"This shows a difference of 20 cents a crate for the Elbertas and 36 cents a crate for the Belles. Another significant fact is that all the sprayed fruit in each case was sold before the buyers began purchasing the unsprayed fruit. It will be seen that the difference in market value in favor of the sprayed fruit, to say nothing of the loss in the orchard, pays the cost of spraying several times over."\*

### COST OF SPRAYING.

The cost of spraying depends upon so many factors that it is difficult to give figures that will apply generally. The following figures are given as a general guide to the cost of spraying.

The self-boiled lime-sulphur-arsenate of lead mixture will cost a trifle over one cent a gallon. One hundred gallons of the

\* Read at Athens, Ga., 1909, and published by the State Board of Entomology and State Horticultural Society.

mixture will spray from 50 to 100 trees, depending upon the size of the trees.

Four men, one to prepare the mixture and three to spray, can spray from 500 to 800 trees a day, with a 200-gallon tank. Figuring on this basis, for good-sized 6-year-old trees, it would cost about  $1\frac{1}{2}$  to 2 cents per tree for each application of the self-boiled lime-sulphur-arsenate of lead mixture. When a power sprayer is used the cost may be less.

Prof. Scott found in his experiments at Fort Valley, Ga., where a power sprayer was used, that the cost was  $5\frac{3}{5}$  cents per tree for four applications of the self-boiled lime-sulphur-arsenate of lead treatment. When we take into consideration the benefit derived from spraying—larger yield, higher per cent. of sound fruit, increased carrying capacity of the fruit and the enhanced value of the fruit—the cost is insignificant.

### **PREPARATION OF SELF-BOILED LIME-SULPHUR.**

The preparation of the self-boiled lime-sulphur mixture is not difficult, but great care should be exercised to see that it is properly made and not allowed to boil too long before diluting. The following directions should be carefully followed:

Weigh out 24 lbs. of lime and 24 lbs. of sulphur. Place the sulphur in a 50-gallon barrel and make into a thin paste by slowly adding cold water and stirring until the sulphur is all moist. If this is not done the sulphur will be in lumps and will not mix readily with the lime. To this sulphur paste add enough cold water to make six gallons, then add the lime. Stir well and add more water as required to keep the mixture from becoming too thick. (We found that we had to add from 4 to 6 gallons of water during the cooking process.) When the lime is all slacked, which should not be more than 15 or 20 minutes, stop further cooking by diluting with cold water. Dilute to 150 gallons and strain. If arsenate of lead is to be used add 6 lbs. to 150 gallons after diluting to the required amount. The arsenate of lead should be dissolved in a small amount of water before adding it to the mixture.

If the cooking is not stopped when the lime is slacked the sulphur will continue to dissolve and the mixture may get

strong enough to injure the peach foliage. What is wanted is a good mechanical mixture of the lime and sulphur with as little of the latter dissolved as possible.

The straining is important, and should be carefully done, or the nozzles will clog while spraying. It is best to make the strainer out of copper gauze of 20 to 25 meshes to the inch. If more convenient the straining may be done when the mixture is diluted to 50 or 100 gallons, and the remainder of the water added afterward. In straining all the sulphur should be washed through if possible. If the mixture is strained before diluting to the required amount, the sulphur can be washed through with clear water from time to time as necessary, keeping account of the amount of water added so as not to make more than the required amount of the mixture. When the arsenate of lead is added to the mixture a great change in color takes place, it becoming a dark brown. This is due to the chemical change that takes place.

To determine just what takes place, or what were the compounds formed when the arsenate of lead was added to the mixture, we had samples of each analyzed by a chemist.

To secure the samples we prepared 150 gallons of the self-boiled lime-sulphur and took a sample from this. Then the arsenate of lead was added and another sample taken.

The analysis of the samples by Dr. Edgar Everhart, Chemist of the State Geological Survey, gave the following results:

The lime-sulphur wash, as given to me, consisted of 172 cc liquid and 7.2968 gm. solids. The filtered liquid carried 0.076 per cent. sulphur in combination with lime as a calcium sulphide. The solid matter contained:

37.40 per cent. free sulphur, and  
32.63 per cent. lime (CaO).

There was also found a large percentage of magnesia, showing the lime used was magnesian.

The "lime-sulphur-lead-arsenate" wash consisted of 160 cc liquid and 6.6225 gm. solids. The filtered liquid carried 0.068 per cent. sulphur as a calcium sulphide. There was found no trace of arsenic in solution. The solid matter contained, beside lead arsenate:

31.57 per cent. free sulphur,  
2.62 per cent. lead sulphide.  
30.91 per cent. lime (CaO).

This lime is also magnesian. The presence of lead sulphide indi-

cates the contemporaneous formation of calcium arsenate, which would be found in the solid matter."

It will be noticed there was found no trace of free arsenic, but the greatest trouble with many brands of arsenate of lead is the presence of water-soluble arsenic.

### **RECOMMENDATIONS.**

Based on the experiments and commercial tests that have been made, we recommend the following treatment for brown rot and curculio:

Spray first about the time the calyces (or shucks, not the colored petals) are shedding, with arsenate of lead 2 lbs., lime 3 lbs., to 50 gallons of water.

Make second application three weeks later, using the self-boiled lime-sulphur and arsenate of lead (8 lbs. of lime, 8 lbs. of sulphur, 2 lbs. of arsenate of lead to 50 gallons of water).

Make the third application about four weeks after the second, using the self-boiled lime-sulphur alone, without the arsenate of lead.

If the curculio is numerous and the trees are hardy and have not been injured by the two applications already made, arsenate of lead may be added to the self-boiled lime-sulphur at the third spraying.

For earlier varieties such as Carman and Hiley make two applications: 1st, when calyces are shedding, and 2nd, about three weeks later.

While we believe that to secure the best results three applications should be made as outlined above, fairly good results may be secured from two applications. In this case make first application as calyces or shucks are shedding, using the self-boiled lime-sulphur and arsenate of lead. Make second application four weeks later using the same kind of mixture.

### **CAUTION.**

In view of the fact that in the experiments mentioned in the forepart of this bulletin, arsenate of lead did, in some cases, injure fruit, and that Mr. Betts injured some of his trees and fruit with arsenate of lead as previously mentioned, we would not recommend it without due caution. But if the mixture is

not made too strong and applied as directed in this bulletin, and the trees are in good condition, we believe the arsenate of lead can be used with safety.

When the results of the experiments with arsenate of lead are compared with the self-boiled lime-sulphur and arsenate of lead mixture, it appears as if it is safer to apply the arsenate of lead with the self-boiled lime-sulphur mixture than alone.

Further experiments will be carried out along this line the coming season by the State Board of Entomology.

### **THANKS FOR ASSISTANCE RENDERED.**

We desire to extend our thanks to the following parties:  
Prof. W. M. Scott and W. T. Ayres for advice and suggestions given.

Betts Bros. for their hearty co-operation with us in the work, and for assistance rendered.

Grasselli Chemical Company for material furnished.

B. G. Pratt Company for material furnished.

### **Manufacturers of Arsenate of Lead.**

Bowker Insecticide Co., 43 Chatham St., Boston, Mass.

Grasselli Chemical Co., Birmingham, Ala.

Merrimac Chemical Co., 33 Broad St., Boston, Mass.

Sherwin-Williams Co., Newark, N. J.

Thomsen Chemical Co., Baltimore, Md.

Vreeland Chemical Co., New York, N. Y.

Most of the above companies have local agents at different points in the State. For information in regard to the name and address of these write the manufacturers direct.

Many drug stores in the larger towns handle arsenate of lead, but usually better prices may be secured by buying direct from the manufacturers.

## NOTICE.

The Bulletins of the Georgia State Board of Entomology, which are of present practical value and still available, are mentioned below. (The numbers not mentioned are either out of date or exhausted.) Application for any of these numbers should be addressed to the State Entomologist, Atlanta, Ga.

Bulletin No. 12.—Mexican Cotton Boll Weevil.

Bulletin No. 13.—Some Common Insects Injurious to the Apple.

Bulletin No. 18.—Pear Blight Disease in Georgia, and Pear Leaf Blight.

Bulletin No. 20.—Part I. Report of State Entomologist for 1905.

Part II. Crop Pest Law and Regulations.

Bulletin No. 21.—Spraying to Control the San Jose Scale.

Bulletin No. 22.—Black Root Disease of Cotton.

Bulletin No. 23.—The Apple Woolly Aphis. Green Apple Leaf Aphis.  
Remedial Measures for Same.

Bulletin No. 24.—Cotton Anthracnose and Cotton "Rusts."

Bulletin No. 26.—Peach Leaf Curl, Yellow, Rosette and Little Peach.

Bulletin No. 27.—Proceedings of Horticultural Society for 1908.

Bulletin No. 28.—"Black Root" Disease of Cotton in Georgia and its  
Control.

Bulletin No. 29.—Codling Moth or "Apple Worm."

Bulletin No. 30.—Proceedings of Horticultural Society for 1909.

Bulletin No. 31.—The San Jose Scale and Some Experiments for its  
Control.

Circular No. 6.—The Use of Soluble Oils Against San Jose Scale.

Circular No. 7.—The Hessian Fly in Georgia.

Circular No. 8.—Report on Experiments for Control of San Jose Scale,  
1907-1908.

Circular No. 9.—The Brown-Tail Moth.

E. L. WORSHAM,  
State Entomologist.

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NO. 2. 1917

GEORGIA  
State Board of Entomology

BULLETIN NO. 14. FEBRUARY 1917.

WILT DISEASE  
of Cotton in Georgia  
and its Control

Cotton Anthracnose

A. J. O. WILKINSON



CHAS. H. WILSON

Atlanta - Georgia

# Georgia State Board of Entomology

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E. O.  
G 342.25

PLATE I.



Fig. 1. Dixie Cotton on left; on right Native Green Seed. Shows great difference in Resistance to Wilt disease. Original.

## ACKNOWLEDGMENTS.

Without the generous co-operation of different cotton planters who have tested our resistant cotton seed and made a report to us upon the same, the work reported upon in this bulletin could not have been carried out so successfully, and we wish to express our sincere appreciation to them for their kindness in this respect. We feel grateful, not only for the reports received, but also for the interest that the planters have shown in the investigations.

We desire to thank especially the following gentlemen:

Prof. W. A. Orton, of the Bureau of Plant Industry, Washington, D. C., for the many valuable suggestions given in the beginning of the work, and for furnishing us with seed of the Dillon and Dixie cottons for planting in 1905 and 1910.

Col. M. B. Council, Americus, Ga., for furnishing land for experimental purposes in 1908, 1909 and 1910.

Hon. B. S. Miller, Columbus, Ga., for furnishing land at Zellobee on which experiments were conducted in 1905, 1906 and 1907.

Mr. Ed Howell, Vienna, Ga., for furnishing land for experimental purposes in 1906, 1907, 1908, 1909 and 1910.

Col. W. D. Hammack, Coleman, Ga., for testing and growing for us different selections and hybrids.

Mr. C. W. Grant, superintendent of Mr. M. B. Council's plantation at De Soto, Ga., for valuable service rendered in looking after the cultivation, etc., of the special lots of cotton.

Mr. R. A. Strain, Darien, Ga., for furnishing land for experimental purposes in conducting anthracnose experiments.

Mr. J. T. Dent, Brunswick, Ga., for growing and testing different varieties and selections in our anthracnose experiments.

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## SUMMARY AND RECOMMENDATIONS.

Wilt disease of cotton is due to a fungus that attacks the roots and stems of the plants, and by its presence in the water ducts of the plant cuts off the food supply thereby stunting or killing the plants attacked.

The fungus lives during the winter in the soil in the decaying cotton roots and stems and also in the form of spores on the cotton and in the soil.

The disease may be spread from one field to another by animals carrying the infected soil on their feet, or by running water washing the soil into an uninfected field. For this reason cattle should not be allowed to roam over infected fields, and the washing of the soil from an infected field into adjoining fields should be prevented if possible.

The disease may be spread on tools, such as plows and cultivators. One way to avoid this is to use separate tools for each piece of land; or else the tools used in the diseased field should be washed with a disinfectant before using them in another field. Corrosive sublimate, one part to 1,000 parts of water, or a 4 per cent. formalin solution may be used as a disinfectant.

Frequently a small but badly infected area is found in the middle or at one side of a field; in such cases it may be well to throw the infected area out of cultivation for three or four years or plant the whole field in some crop not affected by the fungus.

The disease can not be controlled by the application, even in large quantities, of fungicide, such as Bordeaux mixture, copper carbonate, copper sulphate, sulphur, lime and sulphur, formalin, and tobacco dust.

Experiments covering six seasons indicate that the disease can not be controlled by the use or disuse of commercial fertilizers or by the application of large amounts of lime or tobacco dust to the soil.

Date of planting, whether early or late, has but very little if any effect, in reducing the severity of the disease. Late planting is objectionable on account of the reduction in yield.

Variety tests of cotton have shown that while the different varieties vary greatly in their susceptibility to the wilt disease, none that we have tested, except the resistant strains mentioned below, are resistant enough to plant on diseased land.

The Dillon and Dixie cotton originated by Prof. W. A. Orton and three of our strains, the Modella and Grant, and a hybrid which we have not yet named, are quite resistant to the wilt disease of cotton. On diseased land no other varieties of cotton than these should be planted.

Rotation of crops is advisable in order to reduce the wilt fungus. If the land is infested with nematodes, and most of the sandy land in South Georgia is more or less infested, it should be planted for

at least one or two, or better, three years in some crop or crops which will not increase the number of nematodes in the soil before being put in cotton. After this rotation the land may be planted in a resistant strain of cotton and very little of the cotton will die and a good yield may be secured.

In the rotation any of the following crops may be used as they will not support the fungus or nematodes; corn, oats, wheat, rye, Iron cow-pea, velvet bean and peanut.

Parties receiving resistant cotton seed from the State Board of Entomology or elsewhere should be very careful to keep it pure. If this is not done the cotton will not maintain for many years the resistant quality. To keep the cotton resistant care should be exercised to see that no seed is saved from stunted plants. To avoid this go over the field once or twice before the first picking and pull up all the stunted plants. To secure the best results, the seed for planting should be saved only from the part of the field infected with the disease. To avoid mixing the seed at the gin, save the resistant cotton until it is all gathered, except the top crop, before taking it to the gin. Before running it through the gin see that all the seed are removed from the breast of the gin, and let the seed drop out on the floor, or better, on a sheet. It will pay to do this even if you have to pay more to get the cotton ginned.

Our experience and the experience of investigators in other states goes to show that the cotton grower of to-day, in order to raise cotton successfully and profitably, must practice rotation of crops and the selection of seed.

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## **WILT DISEASE OF COTTON**

**In Georgia and Its Control.**

**By A. C. Lewis.**

**Assistant State Entomologist.**

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### **INTRODUCTION.**

The results obtained from the work on the wilt disease of cotton, in 1910, were very satisfactory, and in order to place these latest results in the hands of the cotton planters, it is deemed advisable to issue this bulletin.

In 1909 the Legislature made a special appropriation of \$10,000 to the State Board of Entomology for 1909 and 1910, to carry on the work against the wilt disease of cotton, other plant diseases and insects. This timely appropriation enabled the Board to continue the work, already begun, on a very much larger scale than before. The results secured in the last two years have been very gratifying, both to the farmers and the State Board of Entomology. The results reported before have been confirmed and certain factors, such as the elimination of the nematode worms, have proven to be of prime importance in the control of the disease. If the recommendations given in this bulletin are followed in the future by the cotton growers who have the wilt disease on their farms they will be able to grow a good crop of cotton in spite of the disease.

### **NAME OF DISEASE.**

The disease here described has been known by various names in different localities. It is the "Frenching" in Alabama described by Atkinson, the "Black-root," of South Georgia, and the "Wilt" and "Blight" of other sections. Prof. W. A. Orton says in Farmers' Bulletin No. 333, U. S. Department of Agriculture, "We shall refer to it as "Wilt," because this is expressive and clear and was one of the first names applied to the disease." To conform with this we shall in this bulletin refer to the disease as "Wilt."

### **EARLY HISTORY OF WILT DISEASE.**

Cotton wilt has been in the State for many years, just how long we do not know. There are some planters who remember seeing the

disease fifteen or twenty years ago. In the last few years the wilt has increased in severity and spread very rapidly. In some sections of the cotton belt the disease has been known for twenty to twenty-five years. This disease was first described by Prof. Atkinson in 1892.<sup>a</sup> The etiology and life history of the fungus were first worked out by Dr. Erwin F. Smith, of the Bureau of Plant Industry, from 1895 to 1899.<sup>b</sup> In 1900 Prof. W. A. Orton of the Bureau of Plant Industry, U. S. Department of Agriculture began working on a remedy for the disease. In 1905 the Georgia State Board of Entomology began experimenting on the control of the disease in Georgia. In 1906 Prof. H. R. Fulton, of the Louisiana Agricultural Experiment Station, began working on the disease.<sup>c</sup> This bulletin deals with the experiments carried on in Georgia from 1905-1910.

#### DISTRIBUTION.

Wilt disease of cotton is now known to occur in the following states: North Carolina, South Carolina, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Missouri, Oklahoma and Texas.

In Georgia we know the disease occurs in the following counties: Berrien, Ben Hill, Bibb, Brooks, Burke, Bulloch, Calhoun, Chattahoochee, Colquitt, Columbia, Coweta, Crisp, Decatur, Dooly, Dougherty, Early, Effingham, Emanuel, Grady, Harris, Houston, Irwin, Jefferson, Laurens, Lee, Lowndes, Macon, Marion, McDuffie, Montgomery, Muscogee, Pierce, Pulaski, Randolph, Richmond, Schley, Stewart, Spalding, Sumter, Talbot, Terrell, Telfair, Thomas, Tift, Troup, Washington, Webster and Worth.

#### ANNUAL LOSS FROM WILT.

In 1909, in order to see if we could get some reliable figures on which to base our estimates of the annual loss from the wilt disease in Georgia, we requested parties applying for seed to estimate their losses from wilt for the past season. As a result of this, 568 men gave an estimate of their losses. The loss for each ran from \$10.00 to as high as \$1500. The total estimated loss of the 568 amounted to \$65,498.75, which makes an average of a little over \$115. We sent seed in 1909-1910 to 2,670 farmers. Figuring they lost \$100 each, it would amount to \$267,000. It is probable we do not have one-third of the parties on our list, who have lost over \$100 a year from the disease. Figuring on this basis the total annual loss in the State would amount to \$801,000. This seems to be a very large amount, but let us figure another way and see what the results will be. The disease exists in two-thirds of the cotton growing area of Georgia. From what I have seen in my travels over the State, I believe the disease is present in ten per cent. of the fields in this area and that ten per cent. of the cotton on the average is destroyed in the infected

<sup>a</sup>—Atkinson, George F. "Some Cotton Diseases," Bulletin No. 41, Alabama Agricultural Experiment Station.

<sup>b</sup>—Smith, Erwin F. Wilt Disease of Cotton, Watermelon and Cowpea. Bulletin No. 17, Division Vegetable Physiology and Pathology, U. S. Department of Agriculture, 1899.

<sup>c</sup>—Fulton, H. R. Cotton Wilt, Bulletin 96, Louisiana Agricultural Experimental Station.

fields. In 1909, according to the United States statistics, Georgia had 4,674,000 acres planted in cotton, and harvested 1,800,000 bales, or an average yield of 190 pounds of lint cotton per acre. Figuring from this basis the loss amounts to 11,840 bales. Counting the seed and lint worth \$75 a bale, the total annual loss amounts to \$880,000.

After the above estimate was made a copy was sent to Prof. W. A. Orton, of the Bureau of Plant Industry U. S. Department of Agriculture, Washington, D. C., for his opinion. Following is his reply: "I have read with interest your estimate of the annual loss from wilt in Georgia. Your figures giving a total annual loss of \$880,000 are very conservative. My personal opinion is that the loss of Georgia amounts to at least one million dollars per annum. One has to consider other types of loss besides actual destruction of cotton, for example, the decrease in the selling value of the land, the necessity of planting other less remunerative crops and the increased cost of cultivating wilt infected ground which results from the invasion of crab-grass and other weeds after the cotton is killed."

#### EXTERNAL SYMPTOMS.

The first outward symptom of wilt is generally a wilting of some of the leaves and branches as shown in Fig. 1. Many of the young



**Fig. 1.** Cotton plant dying from Wilt disease. Sketched from photo by Miss Annie Sharp.

plants die within a few days after the first external symptoms of the disease appear, which is usually when they are about six weeks old. Plants will continue to die now and then until frost. Some of the plants attacked may partially recover from the disease, and put out side branches near the ground, but as a rule these branches do not produce much cotton. In the course of time plants killed by the wilt disease lose all their leaves, and the small branches drop off leaving only the blackened stem standing. Many plants that are not killed outright by the disease are much stunted in growth and their yield reduced. This phase of the disease is often overlooked by many planters. In several instances nearly whole fields have been found in this stunted condition and the owner was not even aware that the cotton was diseased.

### INTERNAL SYMPTOMS.

The internal symptoms of this disease are very characteristic, so that it is not difficult to tell wilt from any other disease to which cotton is subject in Georgia. If the roots and stem of a diseased plant are examined after cutting lengthwise, it will be found that the woody portions are black or much discolored. This is the symptom that has given the disease the name "black root."

### THE CAUSE OF WILT.

The cause of the cotton disease commonly called "black root" or "wilt" is a fungus, *Neocosmospora vasinfecta* (Atk.) Erw. Sm., which attacks the roots and stems of the plants. During the winter the fungus lives on the decaying cotton roots and stems in the soil mainly in the form of spores, the spores corresponding to the seeds of the higher plants. In the spring when the cotton begins to form rootlets and roots these are attacked by the fungus. The fungus penetrates the roots and grows up into the stem following the water ducts and plugging them with its mycelium. This prevents the upward flow of the sap from the roots, thus cutting off the food supply and stunting or killing the plant.

### PLANTS ATTACKED BY THE FUNGUS.

So far as known, cotton and okra are the only plants the wilt fungus lives on as a parasite. In some parts of the State cowpeas wilt and die in much the same way as cotton. This disease is caused by a fungus which is closely related to the fungus that attacks cotton. On this kind of land the Iron cowpea should be planted, as it is very resistant to this disease. The watermelon wilt is a similar fungus disease and should be fought by rotation of crops and the planting of resistant seed. Prof. W. A. Orton, Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C., has by selection secured a strain of watermelon that is quite resistant to this disease certain.



PLATE II.



Fig. 1. Nematode Galls on cotton roots. Original.



Fig. 2. On left cotton after cotton; on right, after Iron cowpea. For details see page 14. Original.

## CONDITIONS FAVORABLE TO THE DISEASE.

Some seasons the wilt disease is worse than in others. This may be due to one of two causes, viz, the weather conditions or the number of nematodes in the soil, or both. Thus it has been observed that the disease is more severe during a wet season than in a dry one. Frequently we have received letters from cotton growers stating that in a few days after the last rain, much of their cotton wilted and died. They wanted to know the reason for this, not suspecting before the rain that the cotton was diseased. While it is true that the wet weather is favorable, and dry weather unfavorable to the disease, weather conditions such as heat or cold, have never been known to exterminate the fungus.

## NATURE OF SOIL INFECTED.

A few cotton growers in Georgia have thought that diseased land was deficient in some necessary element or elements of plant food. To determine this we had Dr. Edgar Everhart, chemist of the Georgia Geological Survey, analyze a sample of soil taken from a diseased field at Zellobee, Georgia. His analysis showed the soil was not deficient in any element necessary for plant growth except lime, containing only .047 per cent. of lime. As noted elsewhere the addition of lime to this soil did not reduce the severity of the disease.

The nature of the soil, whether sandy or clayey, seems to govern in a large measure the distribution of the disease in Georgia. It has been observed that the disease is more severe on the loose sandy soils of South Georgia. Thus the sample of soil we had analyzed contained a very large per cent. of sand or silica, 90 per cent. The worst affected spot in a field is usually the lowest place where the sand is washed in, forming a very loose sandy soil. The disease has never been found on the clay soils of Georgia, except in two instances. The fungus causing the wilt disease of cotton may be looked upon as a weed indigenous to some soils, and like them thriving best on certain soils.

## ROTATION OF CROPS.

As the fungus causing the wilt disease of cotton only attacks cotton and okra, it follows that planting the land in other crops will starve out the fungus. Thus far, though, all attempts have failed to completely eradicate the fungus from the soil of infected fields, even with a rotation of ten years. Rotation of crops is important, however, in the control of the wilt disease on account of the nematode worms. For a full discussion of this subject see paragraph on page 11, Relation of Nematode Worms to Wilt.

# REPORT ON EXPERIMENTS FROM 1905 TO 1910.

## NON-EFFECT OF FERTILIZERS.

While many cotton growers are of the opinion that the continued use of commercial fertilizers is responsible in a great measure for the severity of the wilt disease of cotton, others are just as sure that it can be controlled by the use of certain fertilizers, especially muriate or sulphate of potash. To settle this point, we began in 1905 to test different fertilizers to see what effect, if any, they would have on the disease.

The following table gives the grade and amount of each fertilizer used per acre, and the per cent. of cotton that died on each plat.

### FERTILIZERS USED IN WILT EXPERIMENT.

Number pounds per acre.	Fertilizer used.	Per. ct. cotton killed by wilt.
300	Acid Phosphate (16%) .....	74
300	Muriate of Potash .....	82
300	Acid Phosphate (16%) and Muriate of Potash ( $\frac{1}{2}$ of each) .....	76
400	Acid Phosphate (16%) and Guano <sup>a</sup> using $\frac{1}{2}$ of each .....	77
	No Fertilizer .....	75
400	Muriate of Potash and Guano <sup>a</sup> using $\frac{1}{2}$ each .....	72
300	Following mixture: Acid Phosphate (1,000 lbs.); Kainit (500 lbs.); Cottonseed Meal (500 lbs.) .....	90
800	Guano <sup>a</sup> , Acid Phosphate, and Muriate of Potash, using $\frac{1}{3}$ of each.....	74
200	Guano <sup>a</sup> (also tobacco dust 800 lbs. per acre)	82
200	Guano <sup>a</sup> (also fresh lime 1800 lbs. per acre)	80
100	Guano, 8-2-2 .....	78
	No Fertilizer .....	92

From this it will be seen that the variation in the per cent. of cotton that died on the different fertilized and unfertilized plats is not sufficient to indicate that any of the fertilizers were of any marked detriment or benefit in controlling the disease. Thus it will be noticed on the unfertilized plats from 75 to 92 per cent. of the plants died while on the fertilized from 72 to 90 per cent. of the cotton died. We would especially call attention to the fact that muriate of potash was of no benefit in controlling the disease.

## NON-EFFECT OF FUNGICIDES.

Our experiments and those conducted by Prof. W. A. Orton show that fungicides, such as Bordeaux mixture, copper sulphate, copper car-

<sup>a</sup>—Ready mixed fertilizer 10-2-2.

bonate, liver of sulphur, formalin, sulphur, sulphur and lime are of no value in controlling the wilt disease of cotton.

### DATE OF PLANTING.

Many planters have thought that late planted cotton is less injured by wilt than early planted cotton. This opinion had been quite prevalent among planters at Buena Vista, Ga., until one of their number, Mr. J. B. Simons, had a late planted crop in 1905 that died very badly. Mr. Simons' experience is particularly interesting on account of the fact that he not only planted late, but planted on land that had been in other crops during 1903 and 1904. Mr. Simons' field was planted on June 3rd, 1905, following a crop of winter rye. Over 90 per cent. of his cotton died from wilt. This convinced Mr. Simons and other planters around Buena Vista that no benefit could be derived from late planting. In 1908, at Vienna, Georgia, cotton planted after oats died very badly. In our experiments in 1905 one plat of cotton was planted April 18th, and another June 5th. Over 75 per cent. of the cotton died on both plats. From these experiments and observations it is apparent that late planting can not be relied upon as a remedy for the wilt disease of cotton.

### COMPARATIVE RESISTANCE OF DIFFERENT VARIETIES OF COTTON.

In our experiments we have tested so far 54 varieties of cotton, to see if we could find a variety that would be resistant to the wilt disease of cotton. The different varieties showed great variation in the resistance to the disease, but none of them were resistant enough to be worth propagating for this purpose. In all but one of the varieties, namely, Red Shank, 50 per cent. or more of the cotton died from the wilt disease. While the Red Shank was somewhat resistant, 45 per cent. dying, it was discarded on account of its poor yield.

Of the long staple cottons tested, only one, the Mitafifi, showed any marked resistance, and this variety is not adapted to Georgia conditions. In the following list the figures after each variety show the per cent. of cotton that died from wilt disease. In each case here and elsewhere in this bulletin the percentage of dead cotton was determined by actual count made as follows: A few days after the cotton had been chopped out to a stand, a count was made of the number of stalks in each plat, and at the last picking, the live stalks were counted. Stalks nearly dead or badly stunted, enough to be of no value, were counted as dead.

### LIST OF VARIETIES TESTED AND PER CENT. OF EACH THAT DIED.

Short Staple or Upland Cottons.			
Variety	Per Cent. dead	Variety	Per Cent. dead.
Red Shank .....	45	Shank High .....	55
Corley's Wonderful .....	54	Schley .....	55
Boykin .....	55	Sistrunk .....	55

Variety	Per Cent. dead.	Variety	Per Cent. dead.
Hawkins .....	50	Texas Oak .....	66
Lewis' Prize .....	57	Southern Hope .....	66
Tool's Prolific .....	58	Columbia .....	70
Rowden .....	59	Gold Standard .....	70
Augusta Cluster .....	60	Hardin .....	72
Triumph .....	60	Rosser No. 1 .....	75
Dongola .....	61	Poulnot .....	77
Bates .....	61	Excelsior .....	78
Drake's Cluster .....	62	Broadwell's Double-jointed ..	80
Texas Wood .....	62	Brancroft's Herlong .....	80
Allen Big Boll .....	64	Gold Coin .....	80
Layton .....	64	Hasting's Sure Crop .....	80
Pride of Georgia .....	64	Peterkin .....	81
Willett's Red Leaf .....	64	Hasting's Mortgage Lifter ...	85
Bank Account .....	65	King's Early .....	87
Keenan .....	65	Simpkins .....	90
King's Improved .....	65	Cook .....	95
Storm Proof .....	65	Culpepper .....	95
Baughn's .....	66	Russell .....	96

#### Long Staple Cottons.

Mitaffi .....	22	Sea Island .....	66
Floradora .....	50	Boyd's Prolific .....	66
Sunflower .....	50	Clarksville .....	70
Allen .....	63	Ounce Boll .....	70
Griffen .....	64	Edisto Sea Island .....	83

#### Tests of Dillon and Dixie Cottons.

These two varieties of cotton were originated by Prof. W. A. Orton, of the Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D. C. Of the varieties tested in 1900 by Prof. W. A. Orton, the Jackson Limbless was found to be the most resistant to the disease. By continued selection of the most resistant plants from this variety he has secured a strain of this type of cotton which is very resistant to the wilt disease of cotton. This resistant strain he has designated as Dillon. The Dixie originated from a selection made by Prof. W. A. Orton, in Alabama in 1901. In 1905 Prof. Orton kindly furnished us seed of both of these varieties. Each year in our tests they have proven to be quite resistant to the disease, only 10 per cent. to 15 per cent. dying, where 75 per cent. to 95 per cent. of the ordinary varieties died. Fig. 1, Plate 1, shows the comparative resistance of the Dixie and Native Green Seed.

#### RELATION OF NEMATODE WORMS TO WILT.

Many farmers in Georgia know from dear experience that cotton frequently dies very badly when planted after the common cowpea. That this is due to the fact that the cowpea increases the number of nematodes in the soil and that their presence in the cotton roots increases the severity of the wilt disease of cotton is well known.

The nematode worm, *Heterodera radicola* (Greff. Mul.) is a parasite which infests the roots of many plants, and causes the knots commonly known as nematode galls. Affected plants are very much stunted and sometimes killed. A few weeds and a great number of cultivated plants are subject to attack by the nematode worms. The most common of these in Georgia are: Cotton, cowpeas (all varieties except the Iron), watermelons, cucumbers, cantaloupe, sugar cane, okra, cabbage, collard, potato, tobacco, mulberry, peaches, and figs. Fig. 1, Plate 2, shows nematode galls on cotton roots. In addition to the above Prof. Atkinson mentions the following plants as being badly affected in Alabama: Citron, bird's foot clover (*Lotus corniculatus*), rutabaga, parsnip, and salsify." In Farmer's Bulletin No. 333 Prof. W. A. Orton mentions the following weeds as being subject to attack by the nematode worms; purslane, pigweed, (*Amaranthus*), "May-pop," "Indian potato," and "Saw brier." Prof. Orton also states that "Bermuda grass, chufas, and summer oats are slightly susceptible, but probably can be used in rotation when root knot is only slightly prevalent."

#### ROTATION OF CROPS FOR CONTROLLING THE NEMATODE WORMS.

The rotation of crops for controlling nematode worms is so important that we will give in detail some of our observations and experiments along this line. In 1905 Col. W. D. Hammack, of Coleman, Ga., had a field of cotton that well illustrated the result of planting cotton after the common cowpea. In 1903 the field was planted in cotton and the cotton nearly all died with the wilt disease. In 1904 the field was planted in corn and common cowpeas, two rows of corn and then a row of cowpeas. In 1905 the field was planted in cotton. Over 75 per cent. of the cotton died in the rows that had been in cowpeas, while in the rows following the corn only 25 per cent. of the cotton died. At Vienna, Ga., on Mr. Ed Howell's place, a field was sown in oats in the fall of 1906. The next summer after the oats were cut, part of the field was sown in Unknown cowpeas. In the spring of 1908 the whole field was planted in the Dillon and Dixie resistant cotton. The cotton planted after the cowpeas, died very badly, in spots, from 25 per cent. to 50 per cent., while on the other part of the field not over ten per cent. to 15 per cent. died.

In 1905, in our experiments at Zellobee, Georgia, a plat of land was sown in sorghum, on which in 1904 from 75 per cent. to 95 per cent. of the cotton died from the wilt disease. In 1906 this plat was planted in corn and just before the last cultivation Iron cowpeas were sown. In 1907 the plat was planted in Dixie and Native Green seed cotton with the following results: About 25 per cent. of the Native Green seed cotton died and only 5 per cent. of the Dixie cotton. Another very marked difference between this and another adjoining plat which had been in cotton continuously for five years, was that the cotton on the plat which had not been in cotton for two years was twice as

<sup>a</sup>—Alabama Experiment Station, Bulletin No. 9, series, 1899.



Fig. 2. On left cotton after Iron cowpea; on right after cotton. Original.

tall as that on the other plat, and yielded at the rate of a bale to the acre, while the latter yielded one-half bale.

In 1909, in our experiments at Vienna, Georgia, on Mr. Ed Howell's plantation, a plat of land was planted in the Iron cowpea, on which in 1908 over 75 per cent. of the Dillon cotton died from the wilt disease and nematode worms. This land was very badly infested with the nematode worms as was shown by the numerous galls on the roots of the Unknown cowpea, a few of which were growing in the field. Fig. 2, Plate 2, shows nematode galls on roots of Unknown cowpea. On both sides of the plat cotton was planted in 1909. In 1910 the different plats were all planted in the same variety of cotton, the Modella, a resistant strain. The results were as follows: About 5 per cent. of the cotton died in the plat planted after the Iron cowpeas, while on the other plats planted after cotton, from 50 to 90 per cent. of the cotton died. The difference between the two plats is well shown in Fig. 2, Plate 2, and Fig. 2 on page 14. In 1909 we also carried on a similar experiment on Col. M. B. Council's plantation at DeSoto, Georgia, with almost as marked results.

In comparison with this we would call attention to the field shown in Fig. 3 on page 15. This field had been planted for three years in oats and the Unknown cowpea. In 1910 the owner planted it in cotton, just to see what the cotton would do. The result was that nearly all the cotton died where the nematode worms and wilt were present. In a part of the field no wilt disease was present, but the nematode worms were very numerous and here the cotton was very

much stunted, and it also "rusted" very badly. In July, 1910, the writer visited Mr. J. P. Coffee's plantation near Valdosta, Ga., to examine some of his cotton that was not growing well. A careful examination of the cotton roots showed the presence of nematode worms. The small feeding roots were all rotted off and small nematode galls were found on many of the roots. Near a patch of sugar cane the cotton roots showed numerous nematode galls, as shown in Fig. 1,

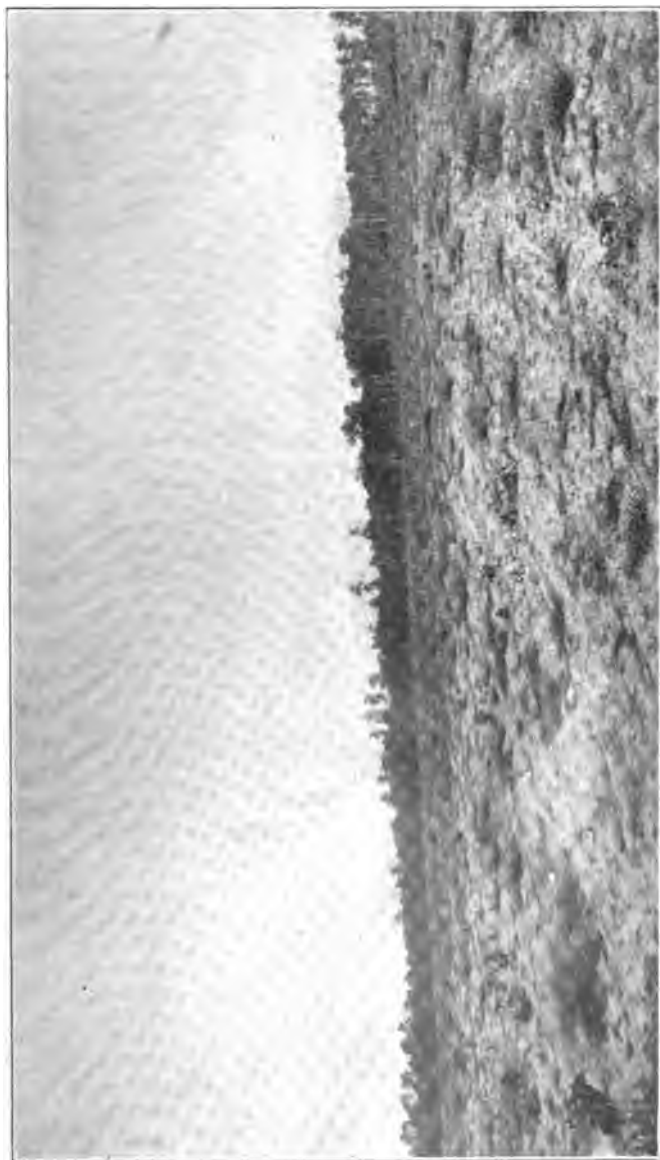


Fig. 3. Cotton field destroyed by Wilt and Nematode Worms; planted after Oats and Unknown cowpea. Compare this with cotton planted after Iron cowpea. Original.

Plate 2. About ten acres of cotton were badly stunted by the nematode worms but not so much of the cotton was dead, as there was not much wilt disease present. Later the writer was informed that the ten acres made a little over two bales of cotton.

Whether the cotton is suffering from the wilt disease or nematode worms, or both, can be determined by examining the roots. The nematode worms do not always produce large galls like those shown in Fig. 1, Plate 2, but the small feeding roots are nearly all destroyed. If the wilt disease is present, the roots and stem near the ground will be black inside, in the woody portion.

These observations and experiments have been given in detail in order to impress upon the cotton growers the importance of rotation of crops in controlling the nematode worms and wilt disease of cotton. There are many fields of cotton in the State, like the last one mentioned above that are much stunted and the yield greatly reduced on

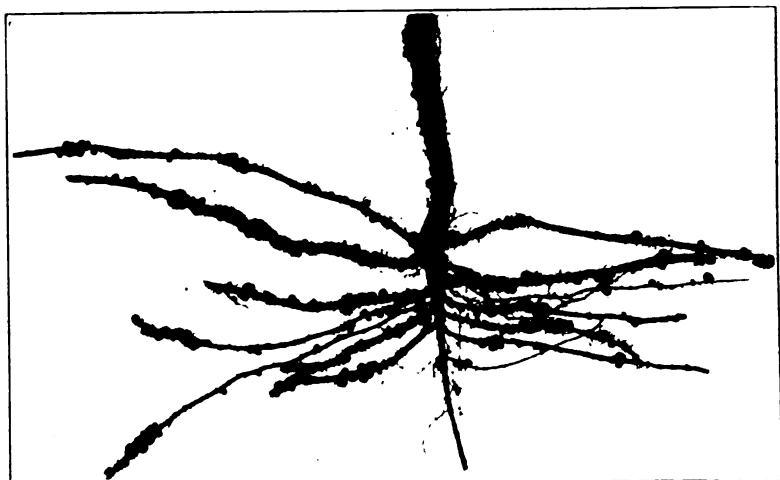


Fig. 4. Nitrogen fixing nodules very numerous on Peanut roots. Original.

account of the nematode worms and wilt. These fields could be made to yield a bale to the acre by a proper system of rotation, and the planting of a resistant strain of cotton. The following crops may be used in the rotation, as they will not support the wilt fungus nor increase the number of nematode worms in the soil: corn, wheat, rye, oats, Iron cowpeas, velvet bean and peanut.

We can not too strongly advocate the planting of the Iron cowpea on land infested with nematode worms. In the above and other experiments we failed to find any nematode galls on the roots of this cowpea. The roots of the Iron cowpea are shown in Fig. 2, Plate 3. In Fig. 1, Plate 3, the roots of the Unknown cowpea are shown. Notice the galls on the roots of the Unknown cowpea.

## DIFFERENCE BETWEEN NEMATODE GALLS AND NITROGEN FIXING NODULES.

The nitrogen fixing nodules are mistaken by some for the nematode galls. The nitrogen fixing nodules appear on the roots as small round shot-like bodies, as shown on the peanut roots in Fig. 4 on page 16. When Nematode Worms attack the roots they become distorted as shown in Figs. 1 and 2, Plate 2, and can not be pulled off without injuring the roots like the nitrogen fixing nodules.

### SELECTION OF SEED FROM RESISTANT PLANTS.

No doubt many cotton planters have noticed that in a badly affected area where nearly all the plants die, or are badly stunted, there may be a few plants that are apparently thrifty and resisting the disease. Evidently these plants are exposed to the disease to a greater or less extent, but do not succumb from some inherent cause. Knowing that Prof. W. A. Orton had by careful selection greatly improved the resistance of the Lillon cotton, we at once began work along the same line to see if we could secure a resistant strain of cotton from some of the varieties commonly grown in Georgia.

### METHOD OF SELECTING SEED.

Some cotton growers make a practice of going through their fields, picking cotton from the best stalks, and planting the seed to improve their cotton. By continuing this process year after year the cotton

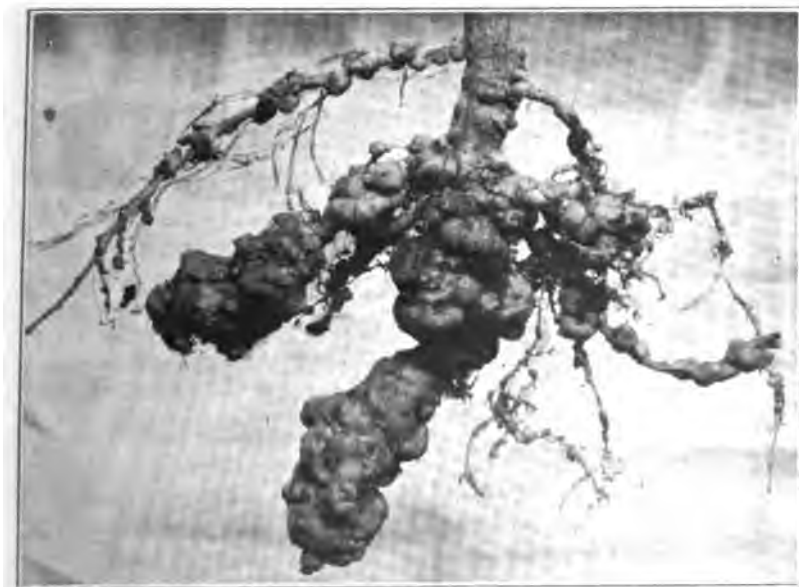


Fig. 5. Nematode galls on Cantaloupe roots. Original.

may be improved to a certain extent. Our experiments and others show, however, that mass selection is a very poor way to secure a resistant strain of cotton, and that even when working for yield alone, individual selection is the better method to use.

In individual selection, or pedigree breeding, a number of the best and most resistant plants are picked, and the seed of each plant saved to itself. The next season a short row is planted from each stalk. The rows are planted side by side and this gives a good opportunity for comparing the progeny from the different stalks, and finding out which selection is the most resistant and has the strongest transmitting power. This is an important point to determine, for it has been found that plants, like animals, vary greatly in their power to transmit certain qualities to their progeny. Thus, ten stalks may be selected which to all appearances are resistant and the progeny rows the next season will show a great variation in resistance to the disease. If any one of the progeny rows shows great resistance and a good yield, it is saved to itself and planted the next season in a multiplying patch. The seed from this in turn is saved and the following season as many acres as possible are planted with it. From this it will be seen that from one stalk in three years a large quantity of seed may be secured.

As an illustration of this variation in different selections let us notice in a brief way the behavior of a few selections, those from the Russell and King's Improved. In 1905 ten plants of the Russell and ten of the Peterkin cotton were selected, all of which seemed to be more or less resistant to the disease. The seed from these different selections were planted in 1906 with the following result:

Russell Selections.		Peterkin Selections.	
Selection	Per Cent.	Selection	Per Cent.
No.	dead.	No.	dead.
1 .....	35	1 .....	16
2 .....	20	2 .....	46
3 .....	42	3 .....	43
4 .....	65	4 .....	75
5 .....	76	5 .....	50
6 .....	80	6 .....	77
7 .....	51	7 .....	50
8 .....	56	8 .....	87
9 .....	70	9 .....	66
10 .....	74	10 .....	70

In 1906 all the Russell selections were discarded except a few good stalks, from Nos. 1, 2 and 3, as over fifty per cent. of the others died. The Peterkin selections were all discarded except a number of good stalks from No. 1. We have each year continued these selections, by re-selection, but have not yet secured a resistant strain of either variety.

Many other varieties of cotton have been taken up in the same way as the Russell and Peterkin, but as to take each up in detail would make too long a report, we will give the results in a general way.

## RESULTS FROM SELECTING RESISTANT PLANTS.

In 1905, 77 different selections were made from 9 different varieties of cotton. In 1906, the progeny of only 11 of these selections were considered worthy of further testing. In 1907, the progeny from only four of these were saved, and in 1908, only two of these were saved for future planting. In 1909, one of the two proved to be quite resistant and was saved and planted in 1910, with very good results. Thus it will be seen that from the 77 selections made in 1905 we now have one resistant strain of cotton.

In 1905, at Vienna, Ga., 50 selections were made from several different varieties of cotton. In 1906 there was one selection that showed such marked resistance, only 16 per cent. dying, that the whole row was saved for planting the next season. This selection is shown in Fig. 1, Plate 4, beside two rows from unselected seed taken from the bin. This strain was propagated as rapidly as possible and seed distributed in 1908, 1909 and 1910. Each year it has proven to be quite resistant to wilt so we have named it the Modella in honor of the Modella farm which belongs to Eggleston & Howell, at Vienna, Ga., where the selection was made.

In 1909, at De Soto, Ga., fifty selections were made, from several different varieties of cotton. In 1910 the progeny row from one of these selections showed great resistance to the wilt disease. This row is shown in Fig. 2, Plate 4, beside two progeny rows from selections from King cotton. This is the most prolific resistant strain of cotton we have yet secured. We have named it Grant, in recognition of the valuable services rendered us by Mr. C. W. Grant, superintendent of Mr. M. B. Council's plantation at De Soto, Ga. This strain will be multiplied as rapidly as possible and seed distributed as soon as we have sufficient quantity.

## HYBRIDIZING EXPERIMENTS.

### (CROSSING VARIETIES.)

In 1905 we began crossing different varieties of cotton with the Dillon and Dixie to see if we could in this way secure a prolific strain of resistant cotton. While it is yet too early to make a detailed report upon the different hybrids, a few of them will be mentioned in a brief way.

In 1905 a number of crosses were made with King's Improved and the Dillon, in the hopes of securing an early resistant strain of cotton. We now have a hybrid from one of these crosses that is very promising. In Fig. 6, the comparative resistance of this hybrid with the Culpepper is well shown. While this hybrid is not so early as the King, it is a few days earlier than the Dillon. Next season we hope to have seed of this hybrid for distribution.

In our variety test it was noted the Egyptian cotton, the Mitaffi, was much more resistant to the nematode worms than any other variety. In 1906 the Dixie was crossed with the Mitaffi to see if we could secure a strain of cotton that would be very resistant, both to the nematode worms and the wilt disease of cotton.



Fig. 6. Shows comparative resistance of Hybrid with Culpepper cotton. Two rows on left Hybrid Dillon  $\times$  King; two rows on right Culpepper. Original.

In our progeny rows this season some of these hybrids showed great resistance to the nematode worms and wilt. We think this one of the most promising hybrids we have. It may take several years of careful selection to fix this hybrid so it will not revert to the Egyptian type, but if we succeed in this, we will have a valuable strain of cotton.

From the results thus far secured we believe this phase of the work, hybridizing, gives promise of some valuable results. Up to date 15 varieties have been crossed with the Dillon, Dixie, King and Mitafifi, and from some of these we hope to secure a strain of cotton that will be more resistant and much earlier than any we have at present.

#### DISTRIBUTION OF RESISTANT COTTON SEED.

The object of the work and experiments on wilt is two fold: 1st, to secure strains of cotton that are resistant to the disease; 2nd, to propagate these resistant strains of cotton and distribute the seed to the cotton growers who have to contend with the disease. On account of the great cost of this work, we were greatly handicapped from lack of funds up to 1909 when the Legislature gave the State Board of Entomology a special appropriation of \$10,000 to carry on this and other phases of our work. This timely appropriation enabled us to enlarge the work on the wilt disease of cotton. The growth of the work is well shown by the following statements: For planting in 1906, seed were sent to twenty different farmers, in 1907 to 81, in 1908 to 89, in 1909 to 125, in 1910 to 2670. For planting in 1910, 1054 of the 2670 also received samples of the Iron cowpeas. We sent each

party from 10 to 20 pounds of cotton seed and to each of the 1054 about 10 pounds of Iron cowpeas.

From the above it will be seen that for planting in 1910 we sent out altogether 3724 sacks of seed. The Southern Express Company very kindly offered to haul the seed at a greatly reduced rate and the Railroad Commission granted the request. This enabled the State Board of Entomology to send out the seed to the farmers without any expense to them. We feel sure that the farmers appreciated this favor from the Southern Express Company and the Railroad Commission.

The importance of this phase of the work, distribution of good resistant seed, is at once apparent to all. It enables us to determine from personal inspection of many of the fields, and from the reports received, whether the cotton is resistant or not and how it yields in different sections of the State. The farmer, though he only gets enough seed to plant an acre or two, can from this start soon have enough to plant his whole farm in this strain of cotton if he so desires.

### PLAN OF FUTURE WORK.

Arrangements have now been made to carry on the work in 1911 and 1912 on a still larger scale than heretofore. We expect to have for distribution for planting in 1911 a larger quantity of seed of both the Iron cowpeas and the resistant cotton than we had in 1910. We hope to be able to furnish each applicant one bushel of the resistant cotton seed and one peck of the Iron cowpeas. In order to serve as many cotton growers as possible we are planning to send the seed by freight and let the party receiving the seed pay the freight on same. This will be exceedingly small to each farmer in comparison with what the seed is worth.

The work on selection and hybridizing will be continued as heretofore. The main effort will be still further to improve the resistance of the strains we have already secured. At the same time an effort will also be made to secure an increase in the yield of these resistant strains of cotton. Other varieties will be tested and an effort will be made to obtain a strain of cotton that will be resistant to the nematodes and the wilt disease of cotton. We are also trying to secure a resistant strain of cotton that will yield a very high per cent. of lint. In 100 selections in 1908 the yield of lint ran from 18 per cent. to 43 per cent. The coming season the progeny from the selection yielding 43 per cent. of lint will be watched with a great deal of interest, as last season, 1909, some stalks of this strain made 40 per cent. of lint. All of our selections that do not yield  $33\frac{1}{2}$  per cent. of lint are discarded, even though they are resistant, as we do not believe that the farmer as yet wants to raise cotton for the seed.

### THE MEXICAN COTTON BOLL WEEVIL AND THE WILT DISEASE OF COTTON.

That dreaded enemy of cotton, the Mexican Cotton Boll Weevil, is not in Georgia yet, but it is coming at the rate of 50 to 75 miles a year, and may reach here in two or three years. The best way to fight

this insect is by certain cultural methods and the planting of a very early variety of cotton. By referring to the list of the different varieties of cotton tested for resistance to wilt on page 11, it will be seen that 87 per cent. of King's early died from the disease. This is the variety that has been so successfully used in Texas in fighting the boll weevil. Hence an effort will be made to secure a resistant strain of cotton from this or some other early variety of cotton, so as to be prepared in a measure for the boll weevil when it arrives in the State.

For the past two years we have been making a number of selections from King and other early varieties of cotton but so far none of these has proven to be very resistant. Two progeny rows from King's selections are shown in Fig. 2, Plate 4. While this season none of the progeny rows from King selections was resistant, they contained a number of good stalks and many of these were selected for testing next season. This season, in one of our resistant strains, the Modella, there were a number of cotton stalks that were much earlier (about 7 days) than the others. A large number of these stalks were selected. This we think promising, and we will endeavor to secure an early resistant strain from these if possible.

From this it will be seen that it may be a difficult task to secure an early resistant strain of cotton, but judging from the progress already made we hope to be able to develop an early resistant strain by the time the Mexican Cotton Boll Weevil reaches Georgia.

#### SUMMARY OF REPORTS FROM INDIVIDUAL PLANTERS WHO HAVE TESTED THE RESISTANT COTTON.

Up to date we have sent seed of the resistant cotton to 2685 planters who have the disease on their farms. Each season a number of these fields have been inspected, and from the most of the others reports have been received. In the following paragraph some of these reports will be given in brief, to show what the results of the tests have been in different sections of the State.

Col. M. B. Council, Americus, Ga., reported that "None of the Dillon cotton died, except in a spot where there had been a watermelon patch the year before, and that 80 per cent. of the adjoining cotton died from the black root disease." The reason for the cotton dying where the watermelons had been was that they had increased the number of nematodes in the soil.

Hon. R. T. Humber, Lumpkin, Ga., reported: "I have planted the seed sent me from your department the last three or four years, and also planted seed raised from them. I find where 75 per cent. of the common cotton will die, 75 per cent. of the immune will live on the same land."

Hon. C. C. Richardson, Byron, Ga., reported that but very little of the Dixie cotton died, where the year before 75 per cent. of the cotton died.

Mr. J. Q. Hall, Sandersville, Ga., reported that but from one to five per cent. of the Dillon cotton, and 50 per cent. of the adjoining cotton died from the disease. The Dillon cotton yielded 1,000 pounds of seed cotton per acre, other cotton only 750 pounds per acre.

Mr. Oscar Aycock, Shellman, Ga., reported that 10 per cent. of the Dixie cotton died, and 50 per cent. of Truitt. The Dixie yielded 900 pounds, Peterkin 1,000 pounds, and Truitt 600 pounds of lint cotton per acre.

Mr. S. S. Sauls, Shellman, Ga., reported that 5 per cent. of the Dixie and 50 per cent. of the adjoining cotton died. The Dixie yielded 1,600 pounds of seed cotton per acre, Hawkins, 1,080 pounds per acre.

Mr. George May, Warthen, Ga., reported that 5 per cent. of the Dillon and 25 per cent. of the adjoining cotton died. Yield of Dixie 1,200 pounds of seed cotton per acre, yield of other cotton not given.

Mr. O. A. Bozeman, Ashburn, Ga., reported that very little of the Dixie cotton died. Yield of Dixie was 2,260 pounds on 3,480 square yards, less than an acre; yield of Russell was 1,350 pounds per acre. Both received the same amount of fertilizer, 600 pounds of a 9-2-4 home mixed guano.

J. W. Edmondson, Moultrie, Ga., reported: "The cotton seed you sent me were planted on a piece of land where I had cotton last year except I ran the rows on through where a cane patch had been the previous year. This year I have not been able to find a stalk of wilt where the seed were planted that I received from you. Nearly all of my own variety of cotton died, where cane was planted last year."

Mr. J. C. Hollingsworth, Dover, Ga., reported: "I counted three rows and they averaged nine stalks to row affected. Other cotton planted by it averaged 61 hills per row affected."

Mr. A. E. Lewis, Hazelhurst, Ga., reported that 75 per cent. of his cotton died and only 25 per cent. of the resistant cotton.

On Jesse Fausts' place, Plains, Ga., in 1909 only 1 to 5 per cent. of the Dixie cotton died from wilt, while 25 to 50 per cent. of the adjoining Peterkin died.

Many other reports similar to these could be given, but these show how the resistant strains of cotton compare with the other varieties of cotton when grown on diseased land.

Many fields have been visited each year where the resistant cotton was planted, and we have seen fields where not 5 per cent. of the resistant cotton was dead, and from 50 to 75 per cent. of the adjoining cotton was dead. Whenever more than 10 to 15 per cent. of the resistant cotton dies, it is due to the presence of nematode worms in the soil. We would recommend that such lands before being planted in cotton, be planted for two or three years in crops that will not support the wilt fungus, or increase the number of nematodes in the soil. These as mentioned before are: corn, wheat, rye, oats, Iron cowpea, velvet bean and peanut.

# COTTON ANTHRACNOSE.

## INTRODUCTION.

The fungus disease of cotton known as Anthracnose is present every year to a greater or less extent in nearly every cotton field in the State. Some seasons, like 1906, when the weather conditions were favorable for the growth of the fungus, the disease may do a great deal of damage. For the last four years, the State Board of Entomology has been conducting experiments on this disease. For two years the work was conducted at Flovilla, but with negative results on account of the failure of the disease to develop to any great extent. For the past two years, the experiments have been conducted at Darien, Ga., on Butler Island, where the conditions are ideal for the development of the disease. The results already secured are promising, hence it is deemed advisable to issue this preliminary report.

We found this summer that many planters mistook the cotton anthracnose for the work of some dreadful cotton insect, and became greatly alarmed, fearing that the Mexican Cotton Boll Weevil occurred in their fields. Hence in the following pages the author has tried to describe the cotton anthracnose, and also the work done by some sucking insects, so that the planter may be able to tell the difference between the two.

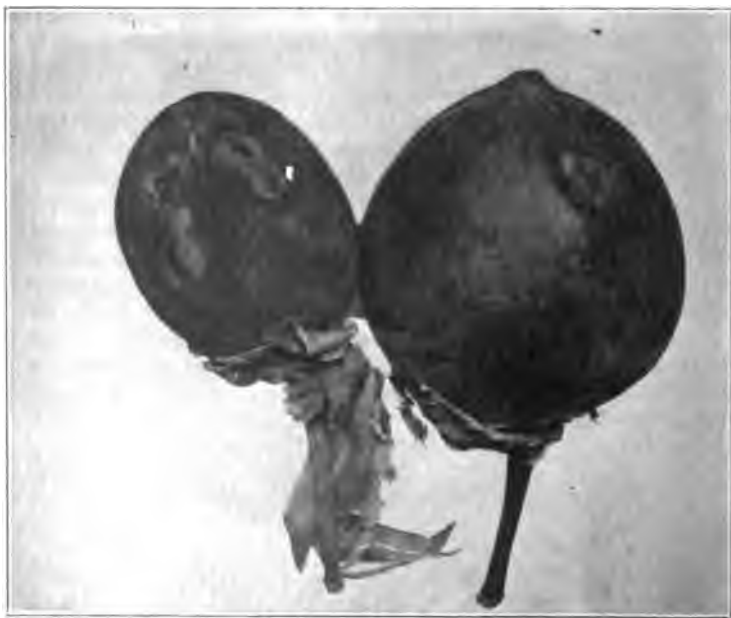


Fig. 7. Anthracnose. Early stage of, on nearly mature cotton bolls. Original.

PLATE III.



Fig. 1. Nematode galls on roots of Unknown cowpea. Original.



Fig. 2. Roots of the Iron cowpea, free from Nematode galls. Original.





Fig. 8. Cotton Bolls nearly destroyed by Anthracnose. Showing how the bolls are prevented from opening normally. Lint all destroyed except in one or two locks. Original.

#### DESCRIPTION OF THE DISEASE.

Anthracnose affects the bolls principally, and causes them to rot and decay. It first appears on the bolls as minute specks which look very much like insect punctures. But unlike insect punctures, they continue to grow until sometimes one-half or two-thirds of the boll is covered. The color of the diseased area varies with the age, becoming a darker brown for a time until the spores are produced, when they have a pink center and border. Later the diseased area may be overgrown with a white fungus and then the pink color will be apparent throughout the diseased area.

At first the small brown spots enlarge in every direction, but if numerous they soon coalesce and become irregular in outline. As soon as the fungus reaches the cotton in the boll it spreads very rapidly and the cotton soon turns black and rots. This happens very frequently when the diseased area is no larger around than a lead pencil. When young bolls are attacked they frequently rot and shrivel up. Such bolls never open, or at least only slightly at the apex. Sometimes only one or two of the carpels of a boll are affected but even then the boll does not open normally. The different stages of the disease are well shown in Fig. 7. In Fig. 8, the manner in which the diseased bolls open and the different degrees of destruction are well shown. It will be seen that all the cotton is destroyed in the boll in the center, and the others all but one lock. Hence it will be seen that the disease destroys many bolls completely, and many more partially. Cotton may be picked from these diseased bolls and the lint and seed in such a case is very liable to be covered with the spores of the fungus. This will again be referred to under remedies.

The author has never found the disease on stems of mature plants but according to Prof. Atkinson,<sup>a</sup> it is sometimes found on mature stems where they are wounded, or at the leaf scars. This disease,

<sup>a</sup>—The Cotton Plant Bul. No. 33, Office of Exp. Sta. U. S. Dept. of Agric.

however, very frequently attacks the stems of young cotton causing them to wilt and die.

Anthracnose also attacks the leaves of the plants, and especially the sickly or weak ones. Prof. Atkinson also found that the cotyledons or seed leaves suffer from a characteristic injury probably caused by the spores that remain on the lint germinating and attacking the cotyledons as they slip through the seed hull and adhering lint. On the fleshy cotyledons the diseased area has the characteristic pink color that is found on the diseased bolls.

#### CAUSE OF ANTHRACNOSE.

This disease, Cotton Anthracnose, is caused by a fungus, *Colletotrichum gossypii* (Southworth) which attacks the bolls, leaves, cotyledons and sometimes the stems of young plants, causing the bolls to rot as described in a previous paragraph. The life history and botanical character of this fungus have been studied and described by Miss Southworth,<sup>a</sup> and Prof. Geo. F. Atkinson.<sup>b</sup> The fungus has been isolated, grown on different media, and inoculations made, so it has been proved beyond a doubt that the disease is caused by the fungus mentioned above.

The question as to just how the fungus grows upon the plant through the summer is not yet definitely settled. Prof. Atkinson failed to find the fungus in all parts of the plant. He thinks there is no evidence to show that the fungus grows in the stem and up to the leaves and the bolls. From the evidence at hand he thinks it very possible that the spores may grow on the diseased leaves and at the leaf scars, producing spores at frequent intervals, and in this manner keep the fungus alive until the bolls appear on the cotton stalks.

#### RELATION OF INSECTS TO THE DISEASE.

Many reports came out in different papers during the season of 1906, stating that the boll weevil, or some kind of cotton insect was destroying the cotton bolls. All of these reports that we investigated proved to be anthracnose, and not the boll weevil or any other cotton insect. In fact, no cotton insect was found except the boll worm, and a brown bug, *Calocoris rapidus*, a few large green soldier bugs, *Nezaria hilaris*, and these only in very small numbers in a few places. In no instance were they numerous enough to do any great amount of damage; but in many of the fields, in nearly all of the rotten bolls, there were found a number of small beetles. These were the insects that the cotton planters always pointed out as the ones that were causing the damage. During the examination by the writer, of many fields of cotton in different parts of the State, these beetles were never seen feeding or breeding in sound cotton bolls.

They were always found feeding and breeding in the diseased and rotten bolls. They seemed to follow and not precede the rot. Hence it is thought they did not cause or even start the disease. After a boll

<sup>a</sup>—Jour. of Mycol., Vol. 6, No. 33, 1890-91, p. 100.

<sup>b</sup>—The Cotton Plant, Bul. 33 p. 293. Office of Exp. Sta., U. S. Dept. of Agric.

has been partially destroyed they take possession of the interior, feeding and laying eggs in the decaying cotton in the boll. Some of these beetles were sent to the Bureau of Entomology, Washington, D. C., where they were identified by Dr. F. H. Chittenden as *Carpophilus dimidatus*, a beetle very frequently found breeding in diseased cotton bolls.

This season, 1910, we frequently received cotton bolls that were destroyed by anthracnose with flower beetles in them. The parties always thought these beetles were responsible for the damage. This beetle which somewhat resembles a June bug has never been known to attack a healthy boll of cotton. They are also sometimes found in peaches and figs where a bird or brown rot has started decay and made a place of entrance for the beetles.

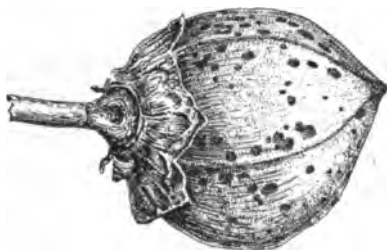


Fig. 9. Cotton boll showing punctures of *Calocoris rapidus*, also shows the unequal growth of the boll. (After Sanderson, Bul. 57, U. S. Department of Agriculture, Bur. of Ent.)

The injury from bugs such as those mentioned above, the Cotton Leaf Bug, *Callicoris rapidus*, and the Green Soldier Bug, *Nezaria hilaria*, is readily distinguished from anthracnose. The wounds made by these bugs become depressed and turn dark, as does the anthracnose in the early stages, but they do not continue to spread like the anthracnose spots, and upon microscopic examination the fungus is not found to be present. This of course is the crucial test and the only reliable one. Small bolls if punctured many times, by insects, very frequently dry up and drop without rotting. Larger bolls if punctured many times, in one or two locks, or on one side, develop one sided as shown in Fig. 9. Sometimes where the insects injury is very severe the boll becomes soft and mushy inside, but do not rot in the same manner as the bolls affected with anthracnose. In Texas, in 1904, the writer saw a number of fields that were very much affected by the brown cotton leaf bug, *Callicoris rapidus*, and the effects were in every case as mentioned above. But strange to say, many of the planters there thought the injury was due to anthracnose. To determine this point beyond a doubt Prof. E. Dwight Sanderson, who was then Entomologist in Texas, had some of the bolls sent to Dr. A. F. Woods, Pathologist of the Bureau of Plant Industry, U. S. Dept. of Agriculture, who reported: "These resemble somewhat the early stages of anthracnose, but we have been unable to find any fungus present, and the spots have not enlarged or developed fungus even after several days in a moist chamber."<sup>a</sup> The bug that caused this injury is shown in Fig. 10.

<sup>a</sup>—Bul. 57, Report on Miscellaneous Cotton Insects in Texas, p. 45, Bur. of Ent., U. S. Dept. of Agric.

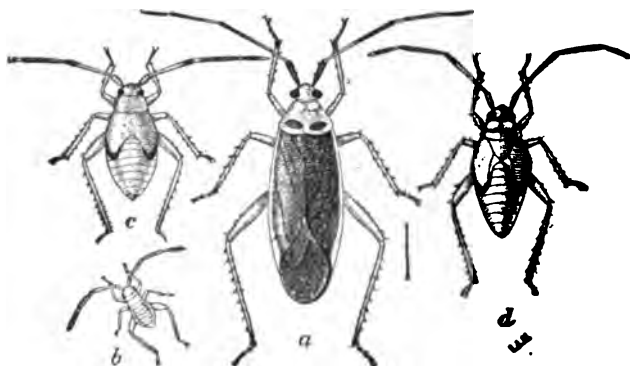


Fig. 10. Brown Cotton Leaf bug, *Calocoris rapitidus*; a, mature bug; b, young nymph; c, fourth stage of nymph; d, fifth stage of young. (After Sanderson, Bul. 57, U. S. Department of Agriculture, Bur. of Ent.)

The writer, during the season of 1906, made a microscopical examination of a number of diseased bolls in different stages of the disease. These examinations failed to reveal any injury from insects, even in the smallest brown specks, which many planters thought to be punctures made by insects. But in each and every case the fungus was present. Furthermore, from observations made in the field, it was found that one of these little brown sunken spots developed in from 24 to 62 hours into a spot as large around as a quarter or half dollar. And in from three to four days two-thirds to three-fourths of the boll would be covered. So from watching these spots one may determine very accurately whether cotton bolls are affected by insects or with anthracnose.

The writer also made some inoculations of healthy bolls by puncturing them with a needle which had been stuck into a diseased boll, and also by rubbing a diseased boll against a healthy one. In each case however, the disease became established on the boll. The disease first became evident on the punctured bolls, on the others a few days thereafter. This shows that the fungus can, under favorable conditions, succeed unaided in attacking and destroying a boll of cotton.

From these facts, mentioned in the above paragraphs and from observations made in many fields in different parts of the State, the writer believes that insects play no part whatever in causing anthracnose, aside from the possibility that certain ones may aid in spreading the disease from one boll to another, or from plant to plant by carrying the spores on their feet or beaks. Biting or sucking insects after feeding on bolls affected by anthracnose would be likely to inoculate healthy bolls.

#### VARIETY TEST.

For the past two years we have been conducting a variety test to find out which was the most resistant to the disease. The following table gives the varieties tested and the per cent. of bolls, by actual count, that were affected by the disease.

Variety.	Per Cent. of bolls affected.	Variety.	Per Cent. of bolls affected.
Bates .....	38.2	Mortgage Lifter .....	40
Allen Longstaple .....	30.5	Peterkin .....	41
Sea Island .....	45	Poor Land .....	31.4
Broadwell's .....	45	Poulnot .....	27
Bank Account .....	21	Pride of Georgia .....	27
Columbia .....	41	Rosser Number One .....	29
Cox Yellow Bloom .....	30	Russell .....	43
Clayton .....	30	Schley .....	18
Dillon—		Simpkins .....	23.3
(Wilt Resistant) .....	24	Sunflower .....	35
Dixie—		Sistrunk .....	17
(Wilt Resistant) .....	21	Tool .....	40
Modella—		Triumph .....	30
(Wilt Resistant) .....	15.4	Willett's Red Leaf .....	11.7
Dongola .....	35	World's Wonder .....	32
Drake .....	31.7	Hybrid—	
Floradora .....	35	Dillon × Russell .....	17
Gold Coin .....	28	Hybrid—	
Hardin .....	39	Dillon × Green Seed ....	20
Lawkins .....	26	Hybrid—	
Keenan .....	37	Dillon × King .....	14
King .....	33	Hybrid—	
Moss Improved—		Dixie × Dillon .....	25
Peterkin .....	33	Hybrid—	
Cook .....	44	Texas B. B. × Dillon ....	19

In considering the results in the above table it must be remembered that the test has been carried on only two years, and for some varieties, only one year, so the results must not be taken as final.

From the tests so far made, it is apparent that no variety is immune to anthracnose. It will be seen from the above table that the resistance of the different varieties to anthracnose varies greatly. For example, Broadwell's had 45% of the bolls affected, Cook's, 44%, Russell, 43%, Tool, 40%, Sistrunk, 17%, Modella, 15%, and Willett's Red Leaf, 11.7%. This indicates that some varieties are very susceptible to the disease and that others are more or less resistant.

Taking the yield into consideration the following varieties seem promising for planting in sections where anthracnose is severe: Sistrunk, Schley, and Modella. While in the tests so far Willett's Red Leaf has shown up very well, its yield has been so poor that we can not recommend it for general planting. In the table it will be noticed, the Cook cotton is very susceptible to the disease and this is the variety that is sent to the office more frequently than any other as being badly affected by anthracnose. This variety yields very well as a rule, and many planters claim that though the Cook was much worse to rot than other varieties they were growing, it gave the largest yield per acre. From this it will be seen that it is a difficult question to decide which is the best variety to plant where anthracnose is very severe.

#### SELECTING SEED FROM RESISTANT PLANTS.

From the fact that in a badly diseased field some stalks will be found on which the bolls are nearly free from anthracnose or more so than

<sup>a</sup>—Seed furnished by Mr. W. E. Sistrunk, Tallassee, Ala.

the rest of the stalks, it would appear that by selecting these resistant stalks for seed we may secure a resistant strain of cotton. When it is remembered that the fungus causing the disease gets into the lint and seed, and may infect the young plants as they are coming through the lint, it will be seen why it is important that seed be saved only from plants that are free or nearly free from the disease. By selecting a number of these resistant plants and saving the seed from each plant separately, and each succeeding year making still further selections it is believed that, after a few years we may develop a strain of cotton that will be very resistant to anthracnose.

In 1906 a number of these resistant plants were selected, but as previously mentioned, on account of no disease being present, no practical results were secured. In 1908 a number of resistant stalks were selected and planted in 1909 and 1910 at Darien, Ga., on Butler Island. The results secured so far from these selections are promising. One selection in 1908 had 5% of the bolls diseased and in 1909 10% diseased. Last season Columbia from a select stalk had 19% of the bolls diseased, while from unselected seed 41% of the bolls were affected. It will also be noticed by referring to the table that some of the hybrids tested are not so badly affected as are most of the varieties. Thus the hybrid between the Dillon and King had less disease (14%) than either the Dillon (24%) or King (33%).

While we do not yet claim to have secured a strain of cotton resistant to anthracnose, we believe from the results already secured that we may do so by a few more years of careful and continued selection. We are also crossing a number of varieties with Willett's Red Leaf to see if we can in this way secure a resistant strain.

## ROTATION OF CROPS.

On account of the nature of anthracnose rotation of crops will be very beneficial as a means of control. It will tend to starve out the fungus by not supplying it with any food plant upon which to grow. Observations made in the last few years also confirm the above statement. It was found that the disease, as a rule, was not near so severe in cotton fields following corn and other crops. While such fields were not free from the disease last season, they were from 25 to 50% better than adjoining fields that had been in cotton for a number of years. In ordinary years the damage to such fields would in all probability be very light, as compared to that in other fields that had been continuously in cotton for a number of years.

## TREATMENT OF SEED FOR PLANTING.

Treating the seed before planting, to kill the spores, has been tried in a small way by Prof. Atkinson. But as will be seen from his report which follows, without very promising results. "In cultures of young plants in sterilized soil annoyance was sometimes caused by the development of the fungus under circumstances such that they could have been diseased in no other way than from spores which remained attached to the seed. Several times during the winter of 1892 and 1893

cotton seed from Alabama was planted in the forcing house and botanical conservatory of Cornell University, and the fungus appeared sufficiently to damp off and disease several seedlings. This seed which was gathered in the season of 1892, afforded a good illustration of the vitality of the fungus. Some of these same seed were planted during the winter of 1893-94 and the fungus appeared upon the stems of the young seedlings. In all cases where the seed were scalded before planting the fungus did not appear. The anthracnose spores were not found in the lint in these experiments, and it may be some, as yet, unknown reproductive body accompany the seed which will retain its vitality for such a long time. The anthracnose spores have been found to germinate when taken from the diseased bolls after five months. In trials of some seed from the same bolls at seven months the spores failed to grow. It is quite possible that the mycelium may rest in the tissues of the seed, as in the case of the bean anthracnose, *Colletotrichum lindemuthianum*, and probably scalding the seed would not kill the mycelium within the tissues without also killing the seed, although this treatment might partially prevent the disease."<sup>a</sup>

From the above it appears that the spores may live over six months, and that the young cotton may get the disease in some cases from seed one and two years old. Scalding the seed might kill the spores but probably would not kill the mycelium within the tissues of the seed. Here, it will be seen, are more points that need further investigation to determine if the seed may be treated in some way to kill the spores and other reproductive bodies if they are present.

## SUMMARY.

Anthracnose of cotton is a fungus disease that attacks all varieties to a greater or less extent. When one has three or four varieties of cotton, the seed should be saved from the variety showing the most resistance to the disease, provided the yield is satisfactory.

As the disease may be carried from one season to another on the seed to secure the best results, seed should be saved from the stalks that are free from the disease. By this method enough seed should be saved to plant an acre or two and then in turn the seed from this could be saved, if it proves better than the general field, for planting next season the field most affected by anthracnose.

At present, no practical method is known of treating the seed to kill the spores of the fungus.

The disease is more severe during a rainy season, but it is present to a greater or less extent every year.

Rotation of crops is advisable as it will tend to reduce the severity of the disease and also increase the yield of cotton.

The following varieties are promising for planting where anthracnose is severe: Sistrunk, Schley and Modella.

<sup>a</sup>—Geo. F. Atkinson. Bul. 33, p. 29, The Cotton Plant, Office of Exp. Station, U. S. Dept. of Agriculture.



PLATE IV.



Fig. 1. Result of planting seed from selected stalks: On left, one row from selected stalk of Excelsior; on right, two rows from unselected seed of Excelsior. Photograph taken Oct. 12, 1906, Vienna, Ga. Original.



Fig. 2. Comparative resistance of different selections. Each row from a different stalk. Row on right very resistant. See page 19 for details. Original.







GEORGIA STATE  
Board of Entomology

E. L. WORSHAM, State Entomologist

Bulletin No. 35.

November, 1911.

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PROCEEDINGS

OF THE

Georgia State Horticultural Society

HELD AT THOMASVILLE, GA.

February 7 and 8, 1911.

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REPORT OF PROCEEDINGS OF THE THIRTY-  
FIFTH ANNUAL MEETING OF THE GEORGIA  
STATE HORTICULTURAL SOCIETY,  
HELD AT THOMASVILLE, GEORGIA,  
FEBRUARY 7-8, 1911.

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The thirty-fifth annual convention of the Georgia State Horticultural Society was called to order in the Thomas County Court House in the City of Thomasville, Ga., at the hour of 10:30 a. m. on the 7th day of February, 1911, by the Secretary, Mr. J. B. Wight, of Cairo, Ga.

SECRETARY WIGHT: Twenty-three years ago, when the State Horticultural Society last met in Thomasville, there was a young minister here who opened with prayer at that time. It is our pleasure to have him with us again today, and he will invoke the blessings of the Master upon us in this meeting—the Rev. George W. Mathews.

Dr. Mathews invoked the divine blessing for a successful and beneficial meeting.

COL. WADE: I rise to place in nomination a gentleman to act as our Chairman until we elect officers of this Association, a gentleman whom I believe is one of our honored vice-presidents, and whom we all know and respect. We cannot stop to say as many nice things as we would like to about him, but I refer to Col. B. W. Hunt, of Eatonton.

COL. HUNT: And I would like to nominate a gentleman. (Cries of sit down.) You can't put me down. We

all have the right to nominate whom we choose—I refer to Mr. R. C. Berckmans. The name of Berckmans stands as no other name in Georgia, and we want one of J. P. Berckmans' hard-working sons, who has inherited his intelligence, his culture, his love for plants, and his love for the Society.

MR. BERCKMANS: I appreciate all that Col. Hunt has said, and I can hardly express myself; but I think it nothing but right that this Society should name him, who is one of its vice-presidents, as chairman of this meeting. Therefore I withdraw my name from consideration, and call for the question.

Col. B. W. Hunt, of Eatonton, was then elected Chairman, who stated: "I thank you very much for this honor. It is an honor, but it is with great modesty that I take the Chair that has been occupied so worthily for thirty-odd years by our dear departed friend—but I will not talk on that subject now, as that will come up later.

Now I am going to ask this of you. We cannot have a successful meeting with any long speeches, with all we have to do, and I hope you will not have hard feelings toward the Chair, if, when in my judgment any man speaks too long, I kindly and out of sympathy for the audience ask him to reduce his remarks to writing.

Our work as it comes up will be done as speedily as it can be done with good order, and, if I can copy a little after Uncle Joe Cannon, "I hope you will bear with me."

MR. BERCKMANS: In the absence of our Treasurer, I nominate Prof. T. H. McHatton as temporary Treasurer of this Society until we have our regular election of officers.

This motion was seconded and carried.

**SECRETARY WIGHT:** I have the badges of the Society here, and those who have paid their dues, or will pay them this morning, are entitled to these. I would like to give them to any one, who is entitled to them. I suppose that these will be admission to all the courtesies that are extended by the citizens of Thomasville. I believe we have a banquet tonight, and other courtesies.

In response to the announcement by the Chairman that the next number on the program would be the address of welcome, the Hon. R. L. Dekle, Mayor of the City of Thomasville, addressed the body, assuring the Society that it was the wish of every citizen of the city that the members partake of the city's hospitality, and that the citizens of Thomasville would do every thing in their power to make the meeting pleasant, profitable, and successful in every way.

The Chairman, Col. B. W. Hunt, of Eatonton, responded in appropriate words to the address of welcome by the Mayor, and thanked the citizens of Thomasville for their good wishes and kind offerings of hospitality.

**COL. WADE:** Would it not be well also, Mr. Chairman, to invite the citizens to attend our meetings? It is not a private meeting.

**CHAIRMAN HUNT:** Certainly, we would be delighted, and if there is a representative of the press present, I would like for the papers to notice that invitation, and especially do we invite the ladies to meet with us. We would be very, very glad to have them come into our meetings, and hear our discussions and the papers we will have read here.

One of the principal duties of man is to pay due and proper respect to the memory of those who have passed before us. This program reads, that after the address

of welcome, would follow a Memoir of Dr. P. J. Berckmans, president of the Society since its organization, by Prof. T. H. McHatton, of the University of Georgia, Athens, Georgia. Prof. McHatton will now deliver that Memoir.

MEMOIR OF DR. P. J. A. BERCKMANS.

BY PROF. T. H. MCHATTON.

Mr. Chairman and Gentlemen:

Dr. Berckmans was to me, as a young man just beginning the profession of horticulture, the pinnacle. I felt that if I could ever attain one small part of the knowledge and prominence that he attained, my life would have been a success. Little did I ever dream that it would be assigned to me to give a Memoir of the Doctor. I felt that the task would devolve upon some one who was far my senior in years and information, one who had known him for more years than I had had life, who had been his close, his intimate friend through all these years in this society; but because of my love for our President during the last few years of his life, I came very close to him. I looked upon him as a friend and a counselor and a father and I appreciated above all things the interest that he seemed to take in me as a young horticulturist—and through this intimacy I learned a good deal, probably as much, if not more, than those who have known him for a good many years, because I made it my business to know his life, and to gain as much of his brain as I could.

Dr. Berckmans, as you all know, was a Belgian, and he was born in Arschoot, Belgium, on the 13th day of October, 1830. Just at the time of his birth his father was called away in the defense of one of the statutes of Liege, and his mother died soon after the return of his father. Consequently Dr. Berckmans, our President, was brought up without the care of a mother.

He was educated in France and Belgium, and started his career as a horticulturist in those countries. Of interest to us, who are familiar with the literature and the history of French horticulture, we might say that Dr. Berckmans' father was himself a pomologist of some repute, and in his home in Belgium worked with numerous fruits. He, being a man that liked horticulture, and the æsthetic side of it primarily, our friend was brought up with the surroundings of beauty and landscapes architecture, and the æsthetic side of horticulture in the beginning, and he learned to love it for itself. He was associated with Van Mons and other men of note in that section, in France and in Europe, and possibly it might be well to note here that his first work in the horticultural line was assisting them in the production of three immense volumes on the fruits of that locality—France and Belgium. In this work the elder Berckmans did most of the illustrating, and Van Mons wrote the descriptions, and Prosper Berckmans the botany. There are only a few of these books, that I can recall, now in this country. One was in the library of

Dr. Berckmans in Augusta, and the other one, that I know of now, is in the library of the Downings, which is at the College of Agriculture in Iowa, and is under the care of Prof. Beech, of that Institution.

Along in 1850 Dr. Berckmans recognized, as many others have, that the chances for a young man in Europe are not equal to those in this country and he decided to come over to America, and as a matter of interest, we might say that on that steamboat, in fact as a stateroom companion of Dr. Berckmans, was Adolph Sutro of California, the man who made many millions in that State, and bequeathed to the State of California the Sutro gardens, which stand as a memorial of him today, as well as the Sutro baths, and other things of interest.

Upon his arrival in this country the first trip that was taken by Dr. Berckmans was to Habersham county, Georgia. He came to that section of the country looking up iron and gold interests, on which they had taken options, to investigate them and see whether or not they would pay them for future work. He didn't intend to settle in this State at that time, and continued his travels, investigating the United States, thinking that probably he would return to his native country if the conditions didn't suit him. During this time he went to St. Louis, and other places along the Mississippi River, and other portions of our country. This was in 1850, and if I had the time it would be a pleasure to me to relate some of the stories of the different cities and the condition that they were in, as he went through them at that period, but we must hurry on.

In about 1851 his father decided to come over and join him in this country, he having made up his mind to stay in America. They then settled in New Jersey, at Plainfield, not at first, but after investigation they bought a home and settled there. It was there that the Downings and other men of pomological reputation in the United States were friends of the Berckmans. I remember well the description that the Doctor gave us of the first meeting with Downing. He was driving down the road, or rather walking down the road, a young man dusty and dirty, having been working at some of the fruits or something, and a gentleman drove along, and stopped him, looked at him and said:

"By the way, can you tell me where I can find the home of Mr. Berckmans? I want to consult with him on some pears."

Young Berckmans said, "I rather think so, he happens to be my father."

Then this gentleman in the buggy said, "Crawl in and take me there." The gentleman in the buggy was Dr. Downing, the pomologist. Later on Mr. Berckmans assisted Mr. A. J. Downing considerably in getting out the second and third editions of "Fruits and Fruit Trees of America," by A. J. Downing, written first by Charles and re-edited later by A. J.

In 1854 he gave up his Belgian allegiance and became a citizen of the United States. While at Plainfield he married Mary Craig, and in a few years came to Georgia and settled at Fruitlands, near Augusta. It was in 1857 that Fruitlands Nurseries were organized and established. At first he was in partnership with a gentleman near Augusta, and later

took the whole interest over, and went to work on his life's work, as probably the greatest nurseryman and pomologist that the South has ever seen, or hopes to see. As a point of interest it might be well to say that the first peaches that were ever shipped from the State of Georgia to New York were shipped from Fruitlands between 1858 and 1860. These peaches sold on the New York markets then at \$5.00 a bushel.

We all know a great deal concerning the work of Dr. Berckmans at Fruitlands. We hardly have realized what we, as a Society, owe to this famous man and his work. The introduction of numerous fruits and ornamentals we owe to him. The Japanese persimmon was first brought into this section through Dr. Berckmans. It was a question if it was not first introduced into the United States through Dr. Berckmans, but at least we know it was the first ever brought on this side of the Rocky Mountains. The introduction and dissemination of many of the peaches, such as Honey and Peento, we can trace directly to Fruitlands. The Japanese plums were first brought over to this country through the Fruitland Nurseries. Some of them originally came from California, and were planted on the Fruitlands place, and then disseminated throughout the South. Amoor River privet and many other ornamentals were introduced into the South, and were disseminated from these nurseries.

It is, however, to the position of our President as a recognized pomologist that we must do homage. The positions that he held at various times were numerous. He was President of the American Pomological Society for some ten years, resigning in 1897, and refusing to serve any longer, having been in for five terms. As you all know, he was the founder and father of the Georgia State Horticultural Society, and all the years of its existence—thirty-odd—never was any other name mentioned for President of this Society but that of Prosper J. Berckmans.

The first meeting, probably, that Dr. Berckmans ever attended in Georgia, was attended in Athens just about the time of the war. His father about that time was made President of a Georgia Horticultural Society, or a similar Society, which lasted only for a few years, and died during the war or just after the war. From that time on there was no other horticultural organization in the State until the founding of this one in 1876, at which time he was elected our President.

Recognizing his worth, and knowing his prominence as an authority on horticultural subjects, the French Societies of Horticulture made him correspondent, he being a member at one time of three or four of these organized Societies of Bordeaux and other places. He was also corresponding member of the Massachusetts Horticultural Society, our oldest horticultural society in America. Later on he was elected an honorary member of the Nebraska Horticultural Society, the Florida Horticultural Society, and also the Alabama Horticultural Society. His writings appear in all of these proceedings, as well as in many of the magazines.

The first production from the pen of Dr. Berckmans in this country can be found in *Hovey's (?) Magazine of Horticulture*. I have forgotten the exact date when it appeared, but in these old files we find two letters, one from Louis Berckmans, Dr. Berckmans' father, and one from

Dr. Berckmans, written in defense of the American pear. Some gentleman of foreign birth evidently had attacked the American-raised pears, and compared them with those of England and Europe. These two letters, one as I say, one by the elder Berckmans, and one by his son, appear in this magazine, defending the American pear. This is the first product from the pen of our President, that can be found, or that I have been able to find, in American writings on horticulture or pomology.

But, hurrying on, I would like to say now, in conclusion, just a few words concerning Dr. Berckmans. If there has been a man in the State of Georgia that has done more toward the advancement, the welfare and the happiness of its people, I do not now recall it. We have had great politicians; we have had great orators; we have had men who probably stood in the public eye to a greater extent than the President of the Georgia Horticultural Society, but I doubt materially if we have ever had a man whose work will live after him as long as that of Prosper Julius Alphonso Berckmans. In the years to come ourselves, and our children, and our grand-children, will look upon the plants that beautify the State, and, if we just glance back into our history for a generation or so we will get back to Dr. Berckmans, the President of our Society.

Gentlemen, I feel wholly inadequate to the task of saying what I would like to say, of telling what I would like to tell you, about Dr. Berckmans. I think one of the saddest days of my life was November 8, 1910, when I received a telegram, notifying me that our President was no more.

The Horticultural Society of the State of Georgia has lost its founder and its friend, and this country has lost a constructor, whose work will live on into time. We all recognized him as a friend, and a gentleman, and as has been said by some of the greatest brains, when we have said that a man is a gentleman, we have said it all.

I thank you for your attention. (Applause.)

THE CHAIRMAN: I would like to change the program slightly, and devote this morning to our departed brother. I think it is right and proper that those who loved him should speak from the floor, and I will ask those who feel moved to do so to rise in your places and say what you feel in your heart you must say.

COL. FORT: I probably knew Dr. Berckmans as long as any man present, and I wish to pay simple tribute to the memory of a man whose life I so much admired. I know of no one who has died of whom it can be said that his life had accomplished so much good. It was for the good of others. His life was devoted to fruits and flowers.

Mr. Berckmans was a man not only of practical ideas in all the lines of his profession, but was a man of great scientific attainment. I was walking with him through his gardens one day, and he was speaking of several plants, giving their scientific and their botanical names, and I asked him if he could give the definition or derivation of nearly all the plants, and he told me he could, and in a very modest and quiet way. I was very much struck with his mastery of his profession.

He lived a long and useful life, and when the time came for him to die in his old age (he died at the age of 83) he could look back on a life of usefulness and benefit to others, an example for all of us to follow. I feel gratified to express my appreciation of the life and character of a man whose integrity was above reproach and whose life of sobriety and attention to duty did so much for the comfort of others.

MR. WORSHAM: Mr. Chairman, I know of no one to whom the State owes a greater debt than to Prosper J. Berckmans, who was one of the greatest men of his time, one of the greatest horticulturists, perhaps, who has ever lived at any time, and one of the greatest citizens of this State. He has rendered a great service to Georgia, to the South and to the entire country. He had an appreciation of both the theoretical and practical sides. His life was a life of service, and there is no one to whom we, as horticulturists, and to whom we, as citizens of this State and Union, owe a greater debt.

There is just one phase of his life to which I want to call attention. He was the father of this Society, and if you will read those proceedings you will see that for years and years he was advocating the establishment of the State Board of Entomology, and he kept hammering

away, kept fighting year after year, until he succeeded in getting an appropriation for that work. As he was the father of the horticultural industry of the State, he could see the necessity of having a department, the duty of which would be to help the horticulturists, and you all know what a great service the Department of Entomology has rendered the State of Georgia. He was the father of the State Board of Entomology, just as he was of the State Horticultural Society. He perhaps appreciated the necessity of having a Department of Entomology more than any other one man in the State, because of his horticultural training, and he was always clamoring for more money to be appropriated to this Department, and it was through his influence largely, after they got a small appropriation, that it was gradually increased from year to year. To know him, Mr. Chairman, was to love him, and it was a pleasure to be in his presence, and I think this Society and the entire country owe him a debt that we can never repay.

COL. WADE: Mr. President, I don't know that I can add anything to what has been said, or that my feelings would allow me to say what I would like to say, but I feel that it is a time, when those of us who have known him so well, should at least cast a flower upon his bier to-day.

I remember in 1876 Dr. Berckmans and I first met. We talked over horticultural matters a great deal. Some twelve years ago I met him here in Macon attending a meeting, and I believe I had the privilege at something like eight of the meetings in the past twelve years of nominating him for President. There was a feeling with us all that probably no other man could ever occupy such a place.

As has been well said, he was the father of our horticulture. Possibly I feel it more than any one else, because twelve years ago I was absolutely at sea on the question of a home for my future life and my family. I believe that P. J. Berckmans, unknowingly possibly, was the father of our industry in Habersham county. He has said more good words about it, and the beauty of it he said, was that he never had to take it back. He said to me: "Wade, I consider that the finest peach section in the country, and I consider it, for certain varieties of apples, the finest country in the world." That settled it for me. I didn't have to go to biological reports, or any other kind of reports; I am there yet. His life was not only a treasure for this State and this Union, but it was international, and every mile-post of his pathway was wreathed in flowers as he passed along.

PROF. WILLIAMS: I feel that this is an appropriate time to express to this Society the very deep feeling of regret and sorrow on the part of our Alabama Society upon learning of the death of Dr. Berckmans. I am unfortunate in not having met Dr. Berckmans, but I felt on learning of his death that it was really a personal loss, besides being a loss to the entire South and to the entire country. I distinctly regret not having met him; however I am familiar with a great many of his writings, and I know that he has been a great help and inspiration to the young Alabama Society (we have only held eight meetings), and I cannot refrain from expressing here that the loss is a great one, not only to your Society but to ours. There cannot be one to take his place, and the fact that his vast knowledge must die with him, without being left to us younger men to carry on, is to be regretted. If we could only carry that store of knowledge

from generation to generation, the knowledge that we cannot get entirely from his writings, but only from personal contact with him, it would be of such great benefit to mankind. I wish to express for the Alabama Society its feeling of exceeding regret in this great loss.

COL. HUNT: Gentlemen, I could not let this meeting pass without putting some of my feelings before you, and I cannot trust myself to say from my heart that which I wish to say, and I have committed it to writing. Whether my voice will carry to where you sit I don't know, but I will read as loud as I well can:

The task is easy of eulogizing men who have become a part of the past of history. Their lives are so far removed from the present that the perspective, the point of view, excludes the trivial and minor details. Our present duty is to one who needs no panegyric to make his virtues known. One who for a third of a century has been our chief and our inspiration, our guide and director in horticulture. One who claimed and held our affection with the strongest bonds has been taken from us. The constant evolution in modern civilization precludes our ever securing a successor who can fill the void created by his absence.

We are living in such an age of specialization that no more men are fitted to know all the departments and heterogeneous details of any calling or profession. Prosper J. Berckmans' knowledge was encyclopedic. His mind had a grasp on all horticulture similar to Herbert Spencer on all the sciences that go to make up philosophic co-ordination. He had the large grasp of taking in a whole, as well as the most wonderful and minute details of all plant life.

Nature, usually, is parsimonious in endowing her favorite children. The intellectual prodigy almost always has a weak side to his character. Before I knew the man we mourn, I was impressed by the catholicity of his written and printed statements. When other nurseries catalogued untried fads and novelties, made money selling to people plants unsuited to their prospective use, the nursery of Berckmans, if he named such plants at all, did so with the warning to the purchaser. His course was not that of the money-accumulating merchant, but rather that of the altruistic scientist who preferred the good of all before any other consideration.

If, as the Eastern proverb declares, a man has not lived in vain who has planted but one tree or made two blades of grass to grow in place of one, what shall we say of this benefactor of the human race who has given all the years of his life to countless efforts to beautify and enrich the earth, to make it bring forth fruit and flowers in due season, and to make it a paradise for man? To accomplish this, to lay the whole world under contribution, and to select its best and most desirable and by

patient experiment and never ceasing toil to evolve results. Fortunate for Georgia, fortunate for you and me, was the choice he made of our State for his home. Born in Belgium, educated in France, familiar with all Europe and all America, he of his own volition chose his home among us. This is a compliment to our section of the South. Those of us born in the Church or in the State are apt to retain a part of our birthright. This is truly following the course of least resistance. What greater factor has our country in this modern world than just such spirits as Oglethorpe, Penn and the English speaking and French born colonists. I never see a worthy emigrant from Europe but my heart goes out to him in sympathy. We need him more than he needs us. Welcome to all who add to our life's fullness.

Of all gentle and noble callings, that of Berckmans, horticulture, appeals to me as bringing more of Heaven to earth than any other work by man. The daily wage earner, if he follow the maxims of Benjamin Franklin, may become opulent, but what is the value of life without the means and facilities of obtaining enjoyment outside of money getting? All games are but trivialities to kill time, reading of books a waste of brain tissue, except co-ordination of the knowledge obtained from the printed page be put to practical use. The sports of hunting, boating, riding, etc., are ephemeral. The work of the horticulturist is endless, progressive, inspiring, always affording pleasure to him who follows the calling, always giving pleasure to them who see the twice-blessed work of his hands. To him who knows botany intimately, every flower, every tree, and every shrub takes on a meaning not appreciated by the non-initiated. The more he learns the more he enjoys. Such work, such information, kept our friend young at eighty years of age. An eternal spring was in his heart. For him the dying calyx was a fount of hope; a type and symbol of beauty yet to be.

The heaviest curse of life, old age of the spirit, was never his. He could see the speeding year without wailing, without fear. Serene and calm from studying nature's miracles, older than time, that declares, "Change I may, but I pass not;" all the forms are fugitive, but the substance survives. He knew that he could not leave the world without a witness to speak of him. Grandeur and glory of verdure, whose vibrant leaves would forever whisper his name from the mountains to the sea; rainbow hued flowers smiling from the sod, emanations of his life and love, would embalm his memory in their perfume. Every cup a pulpit, every leaf a book, and all living creatures telling of him. Not Solomon in all his glory was arrayed like this beauteous throng, who through unnumbered years, should swing their chalices of incense, and chant his praises through earth's green aisles.

For him who has ears to hear, this glorious golden spring, when all nature is awakening, ten thousand floral bells are ringing over our fair land, and their music chimes in voiceless Easter song, "He whom we mourn has arisen." He has arisen with all earth's bloom and beauty his touch created and his care guarded. Think not of him beneath the dark, cold sod, but in the innumerable tenements of beauty, among the rainbow galaxies

of flowers he loved, now up-springing in the light. Think of him as he would love to be remembered, when you caress the velvet petals of the rose or look into the dewey eyes of the violet, or all your being thrill with rapture of the daffodils. He planted sweets for an hundred blossoming springs, and the golden fruitage of the autumn for countless years to be. Flowers for the joy of the living, and flowers for the dead hands to clasp in the darkness of earth's bloom and brightness. He garlanded with beauty the stately mansion, and the humblest cottage as well, and made of desert places sweet scented pictures, whose joy forever abides. The work of his hands still lives. The seed he sowed on earth is up-springing, not only here, but mayhap in fairer lands, that frost and blight can never chill and wither.

In those gardens of delight, may we not picture him today gathering not the dying flowers of the earth, but those of fadeless beauty and everlasting bloom—the immortelles.

MR. HUNNICUTT: A horticulturist is but one type of a farmer, so P. J. Berckmans was a farmer, and as a farmer all true farmers should know more of him and cherish his memory and hold him up as an example to their children to emulate. P. J. Berckmans was one of the most ideal men we ever knew.

He was a perfect gentleman, pure in morals, high-toned in all his dealings, cultured to a striking degree. His face was a clear index of his character. To see him was to like him.

He made a striking success of his business. Fruitland Nurseries have a national reputation. Financially it is a great success, giving him abundant funds to raise his family and to leave them enough of this world's goods. Personally he had an international reputation. Our greatest politicians were not wider known and not so favorably.

He trained his sons in his business and left to them in this business a congenial occupation and a remunerative one. So putting these three things together, no American has done better than P. J. Berckmans, and our farming class should deem it a pleasure and honor

to refer to him as one of their number and as an example of what our sons can do and still be farmers. In fact you will rarely find so well rounded a character, and in this day of specialists we doubt if we can have any more. This is one thing that leads us to farming. Well and successfully followed it tends to develop the highest type of character and necessitates a vast accumulation of information on a wide range of subjects. Yet there are those who think a farmer does not need to read or to be educated.

**CHAIRMAN HUNT:** Governor Hoard, did you know the late Dr. Berckmans?

**EX-GOV. WM. D. HOARD (Wisconsin):** I did not know him personally, I only knew of him, and I do not think I ever met him, but I have been exceedingly interested this morning in the tributes that have been paid to his memory. I am greatly reminded, as you have related here the history of this distinguished student and benefactor of his kind and State, of the wonderfully close parallelism that existed between his life in some respects and that of a distinguished citizen of Sweden, who lived in my own State, Thury Comleen. In 1871 I picked up the CHICAGO TRIBUNE, and read therein a statement from Prof. Agassiz to the effect that Thury Comleen, of Busseyville, Wis., was the greatest authority in the world on birds' nests, a branch or ornithological study, that of course is important. I was amazed because Busseyville was in my own county, the southwest corner of it. I hitched up my horse and started to find this man that was unknown to the politicians, unknown to the statesmen—Who was Thury Comleen?

I commenced inquiring, as I came within about three miles of this hamlet called Busseyville, and no one knew

who he was. Finally coming up within about a mile and a half of the little village I met a man, and inquired of him, "Where does Thury Comleen live?"

"Who do you mean, that crazy old Swede?"

I asked, "Why, is he crazy?"

"Why, of course he is crazy."

"Why do you say he is crazy?"

"Any man is crazy," he replied, "that is poking around in the marshes at night, with a lantern and a net, catching bugs. Of course he is crazy."

I asked him to show me where he lived. When I went to his house he had a little log house and a little farm of forty acres, and he was plowing with a pair of oxen in the most primitive way. He used oxen because he always carried his little shot gun with him, and when he saw a rare bird he could leave his oxen and go off and chase the bird, which he studied with scientific knowledge and understanding. I approached him and found him very shy, not disposed to talk with me much until he found that I was a lover of his branch of study to a certain extent. What did I find? That he was a graduate of the University of Stockholm, and in correspondence with all the learned Societies of Europe, and absolutely unknown within three miles of his home. That's taught me a great lesson, and I call to mind the vision of Peter, when God let down the sheet and bade him rise, slay and eat. He said in modern parlance, "Pardon me, my Maker, I have never eaten anything common or unclean." And then God rebuked him, and said, "Call thou nothing common or unclean." And so, when I hear tributes of this kind to a man who has been a deep student of nature, I find that they are all born with the

same spirit, anxious and earnest to learn the secrets of nature.

I could not isolate myself from such a character as Dr. Berckmans. It would be impossible for me to do so, for all lines of research investigation and thought are more or less correlative. You cannot separate them; they are bound by an indissoluble tie; and every deep student of nature looks up through Nature to Nature's God who has created them and their spirit, and they are akin.

I live in Wisconsin. That's only a little way off. Divisions have arisen between these sections; they have passed like a nightmare, and I think that we all do well in magnifying and paying tribute to the character of this man who has plowed so deeply in the current of Georgia conviction and the conviction of the race, probably to you a thousand times more valuable than the work of all your politicians. It does not take very much to be a politician; it does not take very much human intellect to be a lawyer; but it does take a strong intellect to interpret the laws that God Almighty has made, and these men walk humbly before the Lord. We must feel that, when men have devoted a lifetime, like Dr. Berckmans, to unfolding the secrets of nature that will in time bless his State and his Nation, such men should be held in the very highest esteem and their character and their memory most reverently cherished.

MR. W. T. GAULDEN: Since the days of Moses and Joshua and his successor, and before, in every great movement we find a leader and promoter. So in horticulture. God in his providence raised up, endowed, and gave us P. J. Berckmans.

Into horticulture and kindred sciences he put his

life. That life with its great personality has been a blessing to Georgia, to the South, our country and to the whole world. Among the things that Brooks county feels a just pride in is the fact that one of the three judges at the Georgia State Fair at Savannah, Ga., who awarded to Brooks county the honor and the prize for making the best county exhibit, was P. J. Berckmans.

CHAIRMAN HUNT: On the program this morning we have another paper which will be delivered by Col. John C. Greer, of Tifton, Ga., on the subject of "Figs." We will now hear from Col. Greer.

#### ADDRESS OF COL. JOHN C. GREER.

MR. CHAIRMAN: I feel like it is almost irreverent to disturb the spirit that has fallen upon this meeting with any thing I shall have to say. I am sorry that we cannot leave here with this spirit in our minds and hearts, and return later to take up our program, but if it is the will of the Chair, I shall endeavor to say what I have to say in a most humble spirit, not only in the presence of the eulogies that have been paid to this grand man, but in the august body of scientific men, for being simply a business man with very little scientific training, I naturally feel very humble in your presence. If it were a body of politicians, or other public men, I should feel absolutely at home, but in coming to talk to you about a subject that is so important, and of which you know so much more than I do, all of you can readily understand the embarrassment I feel. I have committed to paper what I shall have to say, and Mr. Chairman, not having been present at any of the previous meetings of this Society, if my paper is too long, I shall not feel embarrassed if you will call me down whenever you feel tired.

#### FIGS.

There appeared some time ago in the *Albany Herald* the following edi-

torial on Figs, which I deem a fitting introduction to the paper which I have been asked to read before your body:

*The Neglected Fig.*—“A neglected fruit is the fig. With a pedigree which reaches as far into the past as goes the history of man, and an established reputation for wholesomeness which ought to make it favored above all but a very few of the fruits which add spice to life and strength to man's digestive apparatus, the fig yet remains in comparative obscurity, boosted not by the builders of empire and the evangelists of development, but almost universally relegated to back yards and fence corners.

Nowhere in the world does the fig attain to more perfect development than in Southwest Georgia. This is a fig country. Every known variety of this ancient fruit finds in the soil and climate of this region every ingredient and every quality essential to the most vigorous growth and most prolific yield. The trees are subject to no diseases, and the crop is as certain as the seasons. Only when they are uprooted and cast away does the usefulness of the trees end. A California fruit man in Albany a few days ago saw figs which astonished him. He had never seen such figs in the greatest fruit-producing State of the Union. They were large as oranges and sweet as sugar, and the owner, of the trees on which they grew refused to allow them to be dug up and shipped to a fruit nursery, though he was offered a really fabulous price for his treasures.

The fig will before long come into its own in Southwest Georgia, for far sighted men are realizing the possibilities of production on an extensive scale. Fig preserves are the highest priced of all preserved fruits, and the supply falls so far short of the demand as to be regarded as almost infinitesimal. Canning plants on the edges of fig orchards will eventually be numbered with the most profitable institutions of the section.

Certain varieties of figs can be successfully shipped, and under refrigeration would reach the Eastern markets from Southwest Georgia in first class condition.

The fig will yet come into its own. It has long been neglected, but it is too valuable a fruit to remain forever a horticultural outcast.”

The history of the fig, as the editorial says, is correlative with that of man. Madam Eve introduced the leaf of this classic tree into the fashions of her day, and there can be no doubt that the attire she wore to afternoon teas was the basis of the modern directoire gown, which had its forks and filaments in a prodigious likeness of the fig leaf.

And did you ever think about it? It was probably a fig and not an apple with which Eve tempted Adam, and caused the human race to fall. The records nowhere tell us that it was an apple, so far as I have been able to find, despite the popular tradition anent that fateful occurrence. The reading of the Scripture text is as follows: “And when the woman saw that the tree was good for food, and it was pleasant to the eyes, and a tree to be desired to make one wise, she took of the fruit thereof, and did eat, and gave unto her husband with her; and he did eat, and the eyes of both were opened, and they knew that they were naked; and they sewed fig leaves together, and made themselves aprons.”

The natural inference almost compels us to believe that it was a fig. The woman saw that the tree was "good for food." Certainly the fig fulfills that encomium. And that it was "pleasant to the eyes." Nothing is more beautiful than a full-leaved fig tree. And a tree to be "desired to make one wise." The abundant brain food in a fig is quite sufficient in itself to have induced the Creator to have called the "Tree of Knowledge," when He warned Adam that he must not partake of it. "She took of the fruit thereof, and did eat, and gave also unto her husband *with her*"—mind you, they were walking through the garden together and stopped under this tree, or by it—"and he did eat. And the eyes of them both were opened, and they knew that they were naked; and they sewed *fig leaves* together, and made themselves aprons." They took the very first leaves they saw and made wearing apparel. The record does not say they went around the Garden of Eden looking for large leaves. They would have selected the caladium or some more comprehensive fabric. They simply took the nearest material at hand the minute the scales dropped from their eyes, and that probably was the leaves from the tree whence came the tempting fruit. And those of us who have studied the fig as a food—its flavor, its nutrition, its wholesomeness,—can readily understand how strong was the temptation which overcame Mother Eve, assuming that it really was a fig which she ate and persuaded her husband to eat.

The prophet Micah, in his graphic description of the millenium, that glorious period when nations shall beat their swords into plowshares and their spears into pruning hooks, says that "nations shall not lift up the sword against a nation, neither shall they learn war any more. But they shall sit every man under his vine and under his fig tree; and none shall make them afraid." Not only has the fig tree been a factor in the life of man since the early dawn of creation, but here we have a prophesy that it shall come again into its own, and be the shelter and solace of man when the world has passed under the benevolent rule of God's Millenium.

I presume it is not expected of me that I should make a scientific dissertation on figs to this body. I do not believe your worthy secretary expected that when he invited me; I do not believe you expect it now. I am not a scientist or a horticulturist. I am a plain business man with a public appendage, and if I can induce through your august body a few more people to think on the fig, this effort will reach the utmost of my hopes, and you will receive your reward in the additional sales from your nurseries.

I want you to study with me for a minute the actual value of the fig as a product. I am told on good authority that the fig has three times as much actual food value in it as a piece of beefsteak or wheat bread of the same size. In the Western Asiatic States in Greece, Italy and the islands of the Mediterranean Sea, the inhabitants substitute fig for meat and the informed tell us it is quite a common thing to see the people there eating sandwiches of barley bread and figs. The fact is, I do not know of any other food combination, except milk, with so many food value ingredients.

It is needless to talk to this company about the delectable quality of the fig. I can see your mouths watering now for a dozen, freshly pulled and peeled, spread over with sugar and Jersey cream, all mashed and mixed until the zone of the fig and cream has been lost and nothing but an indefinite mass of juicy sweetness sits before you, teeming with little crackly seeds and a flavor so rich that the gods would have served it as dessert after a dinner of nectar. And I tell you, my countrymen, once this dish of fresh figs and cream is served on the breakfast table of New York and Chicago, those people will invent a way to get the fig there in its fresh state, even if they have to transport it in airships. There is one thing that we will have to be careful about when we introduce the fig into the North as a fresh fruit; not many people like fresh figs on first trial. Like our superb Georgia syrup, they have a little twang which must be cultivated somewhat to be liked. A few trials will have the desired effect. Eaten once, twice, three times, and the eater is ours. Like the Siren's song and the lotus, all we want is a hearing and a taste, and the fig will do the rest. (I once traveled for the Coca-Cola Company, and the way we got it introduced into new territory was to give a raw recruit three free tickets, each calling for a glass of Coca-Cola. The first one was a little strange, the second was not so bad, and the third went to the spot, and made a regular of him, and he forthwith began to add bricks to the Candler Building.)

The fig is sure to win and become a fad even beyond the deserved fame of the Georgia peach, once we get it properly introduced in the Northern cities in its fresh state. But we are not to wait for that attainment. There is already a big demand for the canned and preserved fig. To the novice the canned fig is not objectionable in the least, but a very delicious viand on first trial. A Northern man will buy a small glass jar containing four canned figs on the Pullman diner, and call for a second and third before he is satisfied. And the canned fig will open the way for the fresh fig in the markets of the East and West—that is, after we have supplied our own tables, for the South is not yet awakened and supplied with this fruit, and will not be, I presume, until we are told by New York that the fig is the greatest of all Southern delicacies.

Not only is the fig delicious and nutritious, but it is wholesome. A fig supper means a well regulated system the next day. The billboards all over the land tell us of the famous Syrup of Figs. In lieu of meats and heavy diets in warm countries and low altitudes where people are naturally inclined to biliousness, why not a diet of figs, which have all the necessary foods a man consumes during a day.

As a commodity of commerce, I repeat what I have published before: "The fig will eventually rival and perhaps excel the peach as a money maker." They have a longer season than the peach, many varieties bear two crops, and there is hardly ever a failure in this section of the South, while as yet there is no insect or scale which has given any serious trouble to the fig. The Mocking Bird and the June bug like the ripe fruit, but I do not anticipate any serious bother from these in large orchards.

As a commercial proposition, we shall have to rely for the present on

the canned and preserved fig and on supplying the Southern or nearby cities with the fresh fig. Canned and preserved figs are already a success in commerce. The Texas growers near Galveston and Houston, whose groves are now about five years old, have been doing a tremendous business in canning and preserving. Canneries at Biloxi and New Orleans have been in successful operation for years. The crop of the past year was a little beyond the facilities of the Texas growers and canners, the trees having borne more than they could handle, and many tons were lost.

Not only have we failed thus far in devising a plan to ship figs successfully in a fresh state to Northern markets, but with our humid climate, we have not been able to dry them successfully. Figs are dried in the sun, and a perfectly dry season is essential when the fruit is ripe. California has such a climate, and in 1909 that State supplied 4,000 tons of dried figs to the American trade.

The two great problems connected with fig growing, I want to lay upon this Society for solution—perhaps you already have them under advisement—an evaporation process for drying figs and an economical method of shipping fresh figs to distant markets for sale in good condition. Those two problems solved will make the fig one of the great money crops of the Gulf and South Atlantic States.

Many of you know that there are two general types of figs—the Smyrna and what is called the “Mule” fig. The Smyrna has a seed with a kernel, will propagate from seed, is richer in food value and superior to the mule fig as a commercial product. The mule fig has a hollow seed, will not propagate from the seed and is almost wholly the fig grown in the Gulf and South Atlantic States. Since the Smyrna is the one best suited for drying, it is the only one that will compete with the dried figs from the East, and the one to whose culture our government and the California growers have for years and years given their attention.

But the Smyrna fig grows female flowers exclusively, and will not mature unless these flowers are “fertilized.” You may set it out; it will grow and make a beautiful tree and put on a fine crop, but before they reach maturity, the last fig will drop off the tree. As I have already said, the United States government and the wealthy fruit growers of California worked on this problem for many years and spent thousands of dollars before they learned the secret of maturing Smyrna figs, which the Asiatics knew and did with ease, but which the growers over there were loath to tell us, lest America should take away their exclusive dried fig trade, which amounts to nearly a million dollars a year in importation to this country. After a long sojourn in that country by an expert, it was discovered that this fertilizing was done by a little wasp called *Blastophaga*. He forthwith bottled up some of the wasps, brought them over and set them to work. They fertilized a few figs and these matured into excellent Smyrna fruit. But when winter came the wasps had no houses to live in and they all died. Then other men were sent back to Asia to learn how to house the *Blastophaga* in winter. After tedious investigation it was discovered that this wasp spent its winters in the heart of the wild

or Capri fig, which carried one crop of its fruit on its limbs through the winter, maturing in the early spring.

Just here I should like to tell you the tragedy of the fig. Those of you who have studied the subject know that the fig blossom is on the inside of the fig, there being a cavity in the centre, where the florescence takes place, and at the bud end of the fig is an opening, and it is through this opening the fig wasp makes her entrance. The Capri fig flowers are partly gall or sterile flowers, and it is in these little receptacles the female wasp lays her eggs. The Smyrna figs having female flowers, there is no receptacle for the eggs, and when she crawls out of the Capri figs which has been hung on the Smyrna tree, she with her legs hung with pollen forthwith begins to look for a place in which to lay her eggs. Finding the Smyrna fig, she forces herself through the small opening at the bud end and on account of the opening being small she loses her wings in the process, and on entering the cavern she looks about for a gall flower for a nest. In so doing she deposits the pollen she has brought from the Capri or male fig on the female flowers of the Smyrna, and thus in her blindness to propagate her kind, she has fertilized the wonderful fig of commerce and made it to mature and ripen; but in so doing she has repeated the sad career of the coral polyp which builds his island in the depths of the sea, and when it is finished gives up the ghost. The fig wasp, finding no gall flower in which to lay her eggs, she becomes heart-broken, says Professor Starnes, and curls up and dies. But she has caused the Smyrna fig to ripen and thus performed a great service to man.

The fig tree finds Georgia a genial clime and soil in which to grow, especially the Southern part of Georgia. It is a semi-tropical flora and the sandy loam soil of the wiregrass country, with the warm Gulf breezes, that blow from the ocean or the Gulf, seems to be as nearly suited for its culture as is the Mediterranean country of Europe and Asia, its original home. It was brought to this country by the Spanish monks, and has found its best habitat in the South Atlantic and Gulf States, and in the Southern part of California. It is often killed in North and Middle Georgia, but seldom ever in this section. Once in my memory has it been killed in the Wiregrass Country.

The fig needs but little cultivation. It is hardy and thrives best where the trash of the woodpile can reach it, and therefore in orchards, it should be mulched at least twice a year. Its roots are small, do not go deep in the ground, and should not be disturbed. Any cultivation should be at a considerable distance from the roots. Pruning is very hurtful to figs; it bleeds them and very little of it should be done. About 120 should be set to the acre. The fig also makes a beautiful border to an orchard of other trees, as well as to a farm of any kind. It is worth the room it occupies, no matter where you set it, or how little care you give it.

Few fruits are as benevolent as the fig. Not only does it give abundant store, with little or no cultivation, but it begins early in life to do this. It will often bear the first year of its growth, but it should not be allowed to do this. Be as generous as it is and pinch off the buttons the first, second and third year, and the succeeding years will repay your generosity

a thousand fold. Its first three or four years should be devoted to putting on foliage. The fifth year our little brown Celeste fig will bear several bushels, and I know a tree in Tift County only eight years old that bore the past year nearly twenty bushels. Trees ten years old should average about five bushels annually. Of course different varieties and different localities differ in production.

A bushel of figs weighs fifty pounds. The canneries pay about four cents a pound for fresh figs. A bushel of figs should can or preserve eight quarts. They are worth wholesale about thirty cents a quart.

Professor Starnes, formerly of the Georgia Experiment Station, is the best authority in this country on figs. Up to the time he left the Station, he was engaged in classifying the many varieties, and he recommends the following twenty-three varieties as among the best grown at the Griffin Station:

Celeste	Marseillaise Grosse
Brunswick	St. Jean Blanc
Brown Turkey	Walker
Ischia White	Angelique or Early Lemon
Moracaine	Bourgeassotte Gris
Beau Dure	Grosse Grise Bifere
Toulousienne	Madelein
Adriatic White	Marseillaise White
Magnolia	Negro Largo
DuRoi	St. Jean Gris
Ischia Black	

In conclusion I desire to say that we are making a trial of these twenty-three varieties in our station at Tifton, or at least we are trying to get these varieties into our orchard, and we hope to plant large orchards when we are able to make selections, and in the meantime, we shall get ready to can them on a large scale. By the time our trees are in full bearing, may I hope that this Society shall have discovered the solution to the two problems that confront us and which I have submitted—Evaporation and Shipping?

**CHAIRMAN HUNT:** It is generally the custom of the Horticultural Society, when we have an excellent paper like this, to fire questions at the author of the paper. Any one, who wants to take advantage of Mr. Greer, now has the chance. Mr. Greer, I see that you omitted one fig that Prof. Starnes recommends, and that is the "Walker."

**MR. GREER:** I named that. In the midst of all that French, however, I am not surprised that you didn't hear it.

**COL. FORT:** It is possible that I ought to make a little statement here. I have several acres in figs in Dougherty county, five years old. I ship figs to Pittsburg with very good results, and in a similar way ship them also to Atlanta. I will just state, without going fully into the matter, that I feel sure that the fig will ship well under refrigeration. I think a great deal of my orchard of figs. The trees are large and capable of producing a great many figs. I had the question of rates up with the railroad authorities for several years, because figs shipped to New York were four times higher than any other fruit.

**QUESTION:** What varieties do you grow?

**COL. FORT:** Green Ischia, and I have shipped from Habersham county in a very small way, White DuRoi, and the Black Ischia. I have 30 or 40 trees in Habersham county, and for breakfast every morning last year for more than a month and a half we gathered figs, 16 in the home, and we had all we wanted.

**MR. GREER:** I would like to be a member of your household, sir.

**PROF. McHATTON:** You mentioned the Blastophaga being brought over from Asia, and the fruit-growers of California working on this problem and spending thousands of dollars on it, and finally importing some of the Blastophaga to fertilize the fruit. I couldn't help but laugh the other day in reading over some reports from California, where they had found that the Blastophaga had been there for forty-odd years. On one of the ranches in Southern California somebody had been kicking about wormy figs, and finally somebody went down there to see about it, and found the Blastophaga. I just

wanted to mention that, because sometimes funny things like that will turn up.

In reference to shipping figs I have frequently carried fresh figs myself to New York. My grandmother up there, a Southerner, is very fond of figs, and we seldom visit her unless some of us take them up there. Some experiments have been started at the station and they were sent in to Washington successfully under refrigeration, and without refrigeration, but we had a little trouble. We started just at that time when the express strike was on, and we got all balled up on our first shipment, and so the results are not very definite as yet.

MR. R. C. BECKMANS: I have listened with a great deal of interest to Mr. Greer's paper on Figs. Regarding transportation I have never gone at it in a commercial way, but I have frequently shipped figs to New York and Philadelphia in open packages most successfully; in fact I have made a dozen or more express shipments, and I have been very successful in getting them there in a perfect state of preservation. The Green Ischia is less liable to crack and less liable to fig sour.

My method of shipping is this: Pick your fruit firm; about 24 hours before they would arrive at perfect maturity they are in a firm stage; set them up on the blossom end, and let the milk and the wound from picking thoroughly dry; wrap them carefully in thin tissue paper, then using an ordinary peach crate or basket, pack them, reversing them each row, first the blossom end down, then the stem end down. In that way I have had them carried with perfect safety to Philadelphia. I believe by that method it would not be necessary to ship in refrigeration, as Col. Fort suggested. When you pick the fig at that stage and dry it out thoroughly, when

it arrives at its destination it is in perfect condition to eat. I think it would be a good idea for some of the people to try that method, which I mention simply as a suggestion. I have not shipped any in a commercial way, but just supplied a few friends of mine in the East with them.

QUESTION: Is that tissue paper porous?

MR. BERCKMANS: Oh yes, it is not a paraffine paper. I don't believe the wax paper is practical, for that would store up the moisture and make them rot. That would be bound to cause the fig to decay. I have always used a porous tissue paper, just one thickness. Dry the fig out thoroughly first with the blossom end down, then wrap one thickness of porous tissue paper, and you will have no trouble from decay due to moisture.

COL. FORT: I tried a little experiment in shipping figs by refrigeration, by what was called "pony refrigeration." I shipped them to Pittsburg, and they created quite a sensation in the market, so I am told, being something new, but they sold for a fair price. If they ripen in dry weather they can be shipped; if in wet weather the fruit is pretty apt to sour.

MR. BERCKMANS: With good, thorough ventilation the fruit carries much better than hermetically sealing it.

CHAIRMAN HUNT: It is very nearly half-past twelve, and I suppose we ought to adjourn for dinner, but before we adjourn I want to say a word to Mr. Greer, and then Mr. Stone has a word to say to us. Since our so-called mule fig has been found to be absolutely fertile, you must withdraw the name "mule," and substitute some other name. Prof Wickson, head of the Department in California, has dropped the name, and, as this "mule"

fig is absolutely susceptible to the male pollen, and fertile, it ought not to be longer abused by being called "mule" fig.

MR. GREER: Well, I wish that this Society might pass a law whereby we should not call these figs any longer "mule" figs. I am sure if you will pass that law, we will not call them "mule" figs in Georgia any more. I don't like the name myself, but I simply called them that, because I was following a higher authority than I pretend to be on the subject of figs.

CHAIRMAN HUNT: Now, Mr. Stone, what is it you have to say to us?

MR. STONE: The citizens of the city this afternoon would like to take every member on an automobile ride to show you the most excellent roads we have in this county, and to show you Thomas county. They ask that you will be at the Court House park here strictly at 3:00 o'clock. Tonight we expect to give a banquet to the Society, which will be at 9:00 o'clock. I state that hour, so that, if you decide to have a session tonight, you may convene before that time. Remember though, the citizens want you at 3:00 o'clock for the automobile ride.

The Chairman accepted this invitation on behalf of the Society, and upon motion the Chairman announced that a session would be held at 6:00 p. m., adjourning, of course, in ample time for the banquet.

The morning session was then adjourned.

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#### THE AUTOMOBILE RIDE.

The automobile ride through Thomas county was greatly enjoyed by all the members of the Society.

The party in charge of the Committee from the City left Thomasville at 3:15, ten machines making the trip,

They were taken down the newly worked Summer Hill Road to Boston, where a short stay was had, and hospitality extended by the citizens of that little city. Immediately after, the party returned to the city by the old Boston Road, which is also being put into excellent shape. Many of them were then carried to the elegant estates about Thomasville, and shown the wonderful landscape gardening and natural beauties of these places.

It was indeed a most enjoyable trip.

The party returned to the City in ample time for the evening session, which convened at 6:00 o'clock.

### EVENING SESSION, FEBRUARY 7, 1911.

The evening session was called to order at 6:00 p. m.

CHAIRMAN HUNT: If we followed the program as printed, the next article would have been "Pre-cooling Fruits for Shipment," by Prof. A. B. Stubenrauch, of the United States Department of Agriculture. Is he here?

SECRETARY WIGHT: No sir, he is not here.

CHAIRMAN HUNT: After him comes "Conservation as Applicable to Horticulture in Georgia," by President W. W. Finley, of the Southern Railway. Is Mr. Finley here?

SECRETARY WIGHT: His paper is here.

CHAIRMAN HUNT: If you all agree, we will have the Secretary read Mr. Finley's paper.

Mr. Wight first read the following letter from Mr. Finley, and then his paper:

Washington, D. C., February 2, 1911.

MR. J. B. WIGHT, Secretary,  
Georgia State Horticultural Society,  
Cairo, Ga.

Dear Sir:

I enclose herewith two copies of the paper, which I promised to write

for the meeting of the Georgia State Horticultural Society, on "Conservation as Applicable to Horticulture in Georgia."

In presenting my paper to the Society, or on some other suitable occasion during the meeting, will you kindly express to your fellow members my high appreciation of their courteous invitation to me to be present, my great personal and official interest in the development of horticulture in the State, and my sincere regret that, on account of circumstances beyond my control, it was impossible for me to be present to read my paper in person.

Yours truly

W. W. FINLEY, President.

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### CONSERVATION AS APPLICABLE TO HORTICULTURE IN GEORGIA.

Paper by W. W. FINLEY, President, Southern Railway Company, Read at the Thirty-Fifth Annual Session of the Georgia State Horticultural Society, Thomasville, Ga., February 7, 1911.

It is important that at the outset we should have a clear understanding of just what we mean by "Conservation." As the word is popularly employed in much of the present day discussion of the conservation of the natural resources, it is used to specify withdrawal from use, and preservation in a state of usefulness. I shall use it in what I think is its proper meaning, as signifying the preservation for use, elimination of waste, and development into the highest usefulness. In this sense, therefore, "Conservation as Applicable to Horticulture in Georgia," is the problem of so using the horticultural advantages of the State as to make them of the highest value.

Your principal advantages, aside from the high capacity which the people of Georgia have shown for horticulture, are favorable climatic and soil conditions, and the accessibility of large markets. Conservation as applied to this industry, then, falls under two branches as applied to production and as applied to marketing. These two branches are closely interwoven. A profitable market is the ultimate object of production, and this should be kept constantly in view.

Conservation as applicable to production is, in a large measure, an individual problem which each grower must work out for himself. So much is dependent upon the chemistry of the soil, its physical characteristics, its surface configuration, and even the direction in which it slopes, that what one man can do to advantage may not indicate what his next door neighbor should do. Each has his own problem, and a large problem may present several problems. I believe, therefore, that each man should make a careful study of the conditions of his own land, and should seek to learn what others have done with the most success on similar soil, similarly located. He will then find it to his advantage to grow those horticultural products for which his conditions are most advantageous, provided, always, he can have a reasonable assurance of a profitable market for those products.

I am not qualified to give the members of the Georgia State Horticultural Society expert advice on the management of fruit lands, the selection of varieties, pruning, spraying, or any of the other purely technical operations having to do with production. I may, however, be able to suggest some lines of development having a bearing on the ultimate object of production—profitable marketing.

It is, I believe, generally recognized by the growers of field crops that diversification is more profitable than one-crop farming. Where this can be carried on under a system of crop-rotation, it is an important factor in conserving and increasing soil productivity. Rotation is, of course, impossible to lands devoted to orchards, but doubtless many of its good results can be accomplished even in orchard lands by planting cover crops and plowing them under.

As to all actual truck crops, I have no doubt it is as beneficial as with cotton and the various grain crops. In fact, in the elaborate experiments carried on at Rothamsted, England, it has been demonstrated that soil in which potatoes are grown, year after year, finally becomes incapable of producing potatoes at all, but, after two or three years of other crops, it is in condition for potatoes. But, in addition to conserving soil productivity, diversification accomplishes the very important result of making the farmer or horticulturist, in a large measure, independent of conditions that may adversely effect the production of marketing of a single crop. I believe, therefore, that the orchardist, as well as the grower of annual crops, will find it to his advantage to diversify to some extent. If, then, he has crop failure or short production of one class of fruit, or if the market conditions affecting it are unfavorable, his other products may turn what would otherwise be a disastrous season into a favorable one.

I may illustrate this by referring to the Georgia peach crop of 1907. The total crop of that year amounted to only 1,500 car loads—a very short crop and a profitable one to such growers as had fair yields, but a very unprofitable one to those whose trees produced few peaches, or none at all. In that year the man who had part of his land devoted to other uses was probably in a better position than the average man who was altogether dependent on his peach crop.

I would further suggest the desirability, as far as it may be practicable, of extending the shipping season for perishable fruits. This would have a tendency in seasons of large production, to avoid glutting the market and breaking down prices, and would also enable the crop to be handled more satisfactorily for all concerned. As our Southern fruit growers have a great advantage in getting their products to market before they meet the active competition of the same kind of fruit grown in Northern localities, I would suggest the desirability of lengthening the shipping season by giving attention to the earlier varieties, as it is not unlikely that, through more gradual marketing of large crops, the result would be better average price for the entire crop.

An element of conservation that may be said to stand midway between production and marketing is packing for shipment. This is one of those technical subjects on which I shall not attempt to give any detailed ad-

vice. It is, however, of great importance, as the condition in which the fruit arrives in market is an important factor in fixing its price. Good packing and care to have the contents of all packages uniform and fully up to the standard of quality indicated by the marks on the outside of the packages will go far to establish and give value to a brand or the name of the shipper.

Conservation as applied to marketing involves, first, the elimination of waste as far as possible. It will generally be more profitable to market the first quality of horticultural products in a fresh state, but, as they are all more or less perishable, it may not always be practicable to do this, and there are always inferior grades and culls to be disposed of. Efforts should be made to find markets for the entire crop. The most important adjunct to a horticultural development, therefore, is the canning industry, or, with some fruits, the drying industry. By preservation by one of these methods practically the entire edible crop that can not be marketed fresh can be saved. I am not sure that it would not be found to be profitable to can a part of the first quality as well as the inferior grades and thus build up a reputation for high-grade canned goods as well as for the fresh fruits. Certainly all of the best quality that may, for any reason, become too ripe to stand shipment should be sent to the canneries. Not even the inedible culls should be allowed to go to waste. In the case of apples they are just what are wanted for the cider press and vinegar factory, and, in the case of some of the other fruits, they are suited for the manufacture of denatured alcohol.

Waste should be eliminated, not only at the producing end, but also at the marketing end. This, I believe, can best be accomplished by co-operative marketing, such as is practiced by the Georgia Fruit Exchange. It is my understanding that the work of this Exchange is confined entirely to the marketing of the peach crop, but I believe the same principle might be applied to the marketing of all perishable products where the volume of production is sufficient to afford a field for such co-operation. It is a manifest impossibility for each individual grower of a perishable fruit to be fully informed as to the relations of supply and demand for that fruit from day to day in all the principal markets of the country.

Another important element in conservation as applied to marketing is adequacy of transportation facilities and efficiency of transportation service. The need for adequate transportation facilities begins at the orchard or garden. The first requisite is a wagon road to the railway station over which loaded vehicles can be moved expeditiously irrespective of weather conditions. All classes of our people are interested in good wagon roads, but none more so than the grower of perishable fruits. His product can be hauled farther to a shipping station over a good road than over a bad one, and, even if he is only a few miles distant and a hard summer rain makes his road impassable right in the midst of his marketing season, he may suffer a substantial loss.

For the production of perishable fruits on any considerable scale adequate and efficient railway service to the great consuming markets of the United States is essential. These fruits must be handled on quick sched-

ules and generally under refrigeration. The value of such fruits is dependent almost entirely upon the performance of such service. This may be illustrated by considering the peach crop of Georgia. If the growers of that State were unable to place their product promptly in the great markets of the Northeastern cities and should still produce 6,000 carloads per annum, peaches in Georgia would be practically without value. It is ability to have them carried to market that gives value to the crop.

The producers of perishable horticultural products are vitally interested, therefore, in the ability of the railways by which they are served to provide adequate facilities and efficient service. Their products move but for a few weeks each year. In one season they may have an output that will tax the facilities of the carriers to the utmost. The next season they may have relatively a very small yield. The railways, however, must be prepared to handle the maximum yield, and they must maintain the trackage and other facilities necessary for doing so for twelve months in every year, even though the volume of traffic may be great enough to utilize their full capacity only for a few days in two or three years.

The railway company I have the honor to represent fully realizes the importance of the horticultural industry of the South, and we are constantly doing all that we reasonably and properly can to encourage it. In planning such improvements as we are able to make from time to time in the way of increasing our double-track mileage, one of the principal things we take into consideration is the handling of this perishable traffic, putting in second tracks first at those places where past experience has demonstrated that delays to fruit trains are most likely to occur. In following this policy we believe that we are contributing materially to the conservation of horticulture in Georgia.

**CHAIRMAN HUNT:** There has been a great movement in Georgia to fight the railroads, but I have always held, and still hold, that the best policy for the Southern farmer is to go in partnership with the railroads—give them part of the profits, and, if you will handle them right, you will get a great deal out of them.

I see by the program that we have a number of addresses for to-night, but I notice one, a "Stereopticon Lecture on Fruit Growing in Oregon," by Prof. E. R. Lake, of the Department of Agriculture at Washington. It occurs to me that we can not very well have a stereopticon lecture unless we have it at night. Is Prof. Lake in the building?

SECRETARY WIGHT: Prof. Lake is detained. It will be impossible for him to be here.

DR. WORSHAM: I want to say that I am on the program for tomorrow and I regret very much it is necessary for me to return to Atlanta tonight. My heart is in the Horticultural Society, and I want to see it succeed, and I want to do every thing in my power to aid the Society. It is very necessary for me to return tonight, however, in order to straighten out certain matters tomorrow that are urgent, and make preparations to be with the Agricultural train, which will be on the road about 50 days, and tomorrow is my last chance to straighten out some very important matters before leaving. I leave my paper with Mr. Lewis, my first assistant, and he will read it when it comes up on the program. I regret very much that I cannot be here, because my heart is with you, and I had rather be here than any where else tonight and tomorrow. For the last three years, however, I have been a perfect slave, and my time has not been my own. I am with you, and I hope you will have a good meeting tonight and tomorrow. (Applause.)

Mr. Wight suggested that as Prof. Worsham had three-quarters of an hour before train time, he might read his paper now, and let something else be substituted for tomorrow.

CHAIRMAN HUNT: If Prof. Worsham would consent to that, I would be glad for it to take that course.

DR. WORSHAM: I would be very glad indeed to do that, but the paper is most too long. The paper I prepared is on Spraying Apparatus for Scale Insects, and goes into detail as to the various types of apparatus used, and those having given the best service in Georgia

for the past five years, and it is too long for me to read it to you tonight.

**CHAIRMAN HUNT:** I want to thank Dr. Worsham for his attendance. It has given us all pleasure to see him, and I hope next year that he will have more time to spend with us.

**DR. WORSHAM:** I want to state further that I had a letter from Mr. Finley, who seemed to regret very much that he couldn't be here, but he had a meeting in New York City which demanded his presence. Mr. Finley selected the subject of Conservation. This subject of Conservation is one which I would like very much to be discussed at this meeting, because it is more misunderstood than perhaps anyother subject. It is one which means more to all of the citizens of the United States than any other one subject I know, because it touches every phase of human activity, and it is one in which this Society has been very active, perhaps under a different name. We are all working for Conservation. Horticulture is nothing more than a conservation of fruits and flowers, and all those things for the good of mankind, and it applies to almost every thing, and I don't know anything that is more intensely interesting to all citizens who really love to live, and who love beautiful things in Nature and who are interested in something else besides themselves.

I regret very much that Mr. Finley could not be here, and present that subject for himself. This is a movement with which I have been somewhat identified myself, and I hope very much that we can make a success of it in Georgia and in the South, and I want the co-operation of this Society, because it represents one of the most important phases of conservation. I hope at the

next meeting we can have something along this particular line. I know that we can depend upon the co-operation of this body, and that they will do everything in their power to make the movement a success.

**CHAIRMAN HUNT:** Next on the program is an address by Prof. P. F. Williams, of the Alabama Experiment Station, Auburn, Ala.

#### ADDRESS OF PROF. P. F. WILLIAMS, OF AUBURN, ALA.

Gentlemen: I have no prepared paper and I can hardly call what I have to say an address. I will say, though, in the beginning, that I am glad to be with you. I have wanted to come over to your meetings for the last three years, but have not been able to make it. We held our meeting of the Alabama Society in Birmingham on the 19th and 20th, and I would say that, although our Society is young, the spirit manifested was as fine as I ever hope to see. When this body of 75 men get together and display the interest and the enthusiasm and the spirit that the men did there, our Horticultural Society, we feel, is doing the work that it should.

Now, there are a number of different views to take of Horticultural Societies, and there are only comparatively few of us who have taken the broad attitude toward these Societies that we should. For instance, I had a letter from one of the members the other day in which he said he was very glad to give his dollar, but he didn't believe it was treating him right to let his neighbor have our proceedings without any cost to him in cash. He said the other fellow was getting everything out of it that he could without putting a cent into it. That's wrong, but we must take a different attitude, if we are going to have progressive horticulture or agriculture in our Southland. Membership to us means something besides proceedings; it means our personal interest in these societies; and friendship is the finest thing we can have in developing any organization. We can get together and know each other—we can write our troubles to each other, but the feeling is left out—we need to get together, and imbibe from each other this spirit of good fellowship and friendship.

Now, I must be brief, because I know how it was in closing up our Birmingham meeting. I know tomorrow is going to be filled up with discussions, but I want to make a few remarks regarding the progress of horticultural work in Alabama. Of course you know Georgia is conceded to be a cotton State; Alabama is the same way, that is, not strongly a horticultural State, and in that way we are perhaps handicapped, but the field in Alabama and Georgia for horticulture is such a great one that our Horticultural Societies have really had before them the greatest work that an organization could have for its development.

We are just beginning. Of course, your Society is thirty-odd years old, and ours is only eight, and some of the finest things are in your proceedings that can be found in any similar proceedings in this country, both from a practical and scientific standpoint. They are fine.

Our chief work at present is with the pecan. There's more interest among the people in the State, and among people we expect as settlers there, than ever before. Attention is being confined mostly to the Baldwin pecan. We are getting letters every day from people in North and Northwest, particularly in the Northwest, and people who went out into the Canadian Northwest are really getting frozen out there, and its getting too cold for them, and they are coming South. Those men you will find are mostly fruit men, men who have had experience in some particular line of fruit work, and they are willing to get down and dig and delve, and you know it takes that for fruit growing in the South. This climate is ideal; our soil is all right, but the growing season is so long, and the atmospheric conditions, etc., are so conducive to the rapid spread of disease, insects, fungi, etc., that we must give closer attention to cultivation, spraying, etc.

Now, as you know, I think it was in the last proceedings—there was a lengthy article on the use of arsenate of lead and sulphur for the control of the curculio and the brown rot. We have established the fact that these are closely related, and that they can be fought at practically the same time. That's one of the greatest discoveries made in recent years.

Regarding pecans and oranges, not in a boastful way, I might say, but as a matter of interest generally, we perhaps have the largest combination orchards in the South about six miles from Mobile, and although it is Northern capital and Northern people who are interested in it, which recalls to mind what the "Fig" man brought out this morning, that the Northern people have to tell us how good things are before we realize it, still I will say it is one of the finest orchards in the whole Southern country. They grow Satsuma oranges, and those of you who have tasted real good, fair samples will say, I am sure, that it is one of the finest oranges they ever tasted. Right on that point I just picked up a little pamphlet here, and I want to read this extract from it. It is under the head, Satsuma Oranges:

"While the Satsuma orange has not been extensively cultivated in this country or section, yet the trees that are growing and bearing in this section give promise of an industry that will eventually rival the orange industry in Florida. The Satsuma orange is a product of Burbank, the horticultural wizard. It is the sweet orange grafted into the hedge orange stem, which defies the cold in climates far colder than this."

The Satsuma orange, as far as we can find, dates back for several hundred years to Japan, more properly China, and it was introduced into this country within the past twenty-five years. I think the first tree was planted in Florida, and since that time the planting has spread as far West as Texas. In Texas today there is some very extensive planting being put in. In speaking of this combination orchard near Mobile, I will state that there are 2,400 acres having 16,000 pecans budded and grafted, and

48,000 Satsuma oranges. So you can get some idea of the extent of their planting, and how much faith they have in what the trees will produce. I wish I had the time to take up the Satsuma orange in detail. I think it should be tried even here. It will stand as low a temperature as 14 to 15 degrees, that is, for a day or so, with the tree dormant. The Satsuma orange is bringing growers handsome returns down there in Mobile County and Baldwin County. At present the cities of Mobile and New Orleans are consuming most of the crop. The way they handle it there, they simply ship them in barrels, and those barrels contain about 600 or 700 fruit, and sell for \$18.00 and \$19.00 per barrel. I have a friend who cleared \$1,400 on 2 1-3 acres in 1909. As yet we know very little about commercial Satsuma orange-growing in our State. It is under investigation now. We have unfortunately not had sufficient funds to carry on sufficient co-operative work, but our Legislature has recently passed an appropriation of \$50,000 for Experiment Station work alone, and that's been the thing we have been in great need of, and we hope now to produce results by having that to work on, and having more men in the field to begin active duty.

Now, apple-growing in Alabama has not progressed as rapidly as I would like to see it. Conditions in the Northern part of the State, however, appear to me very favorable. One man, who had 200 acres, was constantly saying that apple-growing in Alabama was not a success, but I finally got him to admit that he had not given proper attention to those trees, and in three or four years he let them go. You have got to pay close attention to any of this work to make it effective.

Now, something as to the College. Within the past two years they have erected at the Alabama Polytechnic Institute a \$75,000 Agricultural Building, probably one of the finest in the South. Unfortunately we didn't have money enough to properly equip it, but the general agricultural and horticultural movement in the State in the last two years is really surprising. When I first came to Auburn three years ago, in looking over the students in the course, particularly in agriculture, I found that those men were simply men weeded out of other courses, that is, if they had fallen down in mathematics or chemistry, or whatever course it might be, agriculture was the dumping ground. We had to take them. Now, in three years that thing has simply entirely changed. Agriculture is a pedagogic study, and it can be taught in such a way as to interest men of some standing and quality, and today I would be glad to take every one present right into the class room and be willing to take his judgment as to the merits, quality, and culture of those courses. In fact, the total number of men taking agriculture exceeds that of any other course in the Institution, whereas, heretofore we have had a mechanical Institution. I see my time is running short, and if you will shut me off at any time, I will not feel hurt. There are so many things that can be said about horticulture, and what a field it is, that there is really no stopping place.

Now, you know that Mobile and Baldwin counties are great truck-producers. Twenty years ago the entire business carried on in and about Mobile county could be bought for \$50,000.00. Today, including the tobacco

industry, and the various agricultural products, cotton, corn, and so on, a million dollars would hardly cover it. I have those figures from one of the largest wholesale produce men in Mobile, who has made a close study of that work for 30 years. \$50,000 would hardly cover the truck of Baldwin county alone. When they first started in, cotton was the crop. Today all sorts of truck, snap beans, English peas, and the like comprise shipments to Northern markets, going out in carload lots, and Mobile products are known all over the East.

I think I have covered, in a general way, the various points that have come under my particular notice. I sometimes feel that when we feel ourselves that we are progressing, we are standing still, and, when we feel that we are doing nothing, we are perhaps accomplishing something, and yet that feeling comes to me more often than perhaps any other.

Another point that I expect you have noticed before this. I am called to go round the State occasionally, and make talks on various horticultural subjects, and sometimes I feel a little bit diffident about doing it. We had two very charming young ladies, General Joe Wheeler's daughters, attending the horticultural meeting in Birmingham, and, when I met them, I noticed they stepped back and acted as though I had hurt their feelings. Then they said, "Why, I am surprised; we supposed we were going to see a man with chin whiskers and gray hair; we never thought we would see a youngster like you." Now, that's the way some folks look at it, that we are going to lay back and wait until we get gray hair to get into this sort of work, and, if we do that, there is so little time left that we might as well stop entirely. None of us are going to learn all about horticulture. The field is too broad. That's one great trouble with some of our Experiment Station work. We try to do too much shorthanded. Those of you present know that, but the layman does not know it. Now, the laymen say, "What's the use of teaching horticulture, and animal husbandry, and agriculture, and all that? Why not have it all Agriculture?" That's what the laymen say, but take horticulture alone, or any one branch of it, and its simply immense, and I think, if we go at it in that way, to perfect ourselves in one or more branches, we will really accomplish something.

I hope a number of you gentlemen present will be able to attend the pomological meeting in Florida. It has been thirty years since that organization has been South, and it is a tribute that we should pay them, to give them a large attendance. I have had to neglect my work and duties to make the trip, but I feel in a way that I am justified in doing that, to show that our Southern States are as active as they can be in these various lines, and to show the majority of these people there at Tampa that we are awake to conditions here, and that we have the finest opportunities in our Southern States that can be found in any section of this country.

Now, if there are any questions upon the points that I have touched upon lightly, I will be glad to take more time in an effort to answer them.

**MR. GREER:** I would like to ask about those Satsuma

oranges. How large an acreage have they at that place near Mobile?

PROF. WILLIAMS: They intend to have 2400 acres. they have about 800 growing.

MR. GREER: How old are the old trees?

PROF. WILLIAMS: Two years.

MR. GREER: How far can they be planted apart?

PROF. WILLIAMS: 18 feet.

QUESTION: Professor, about what date does the Satsuma bloom, and what is the farthest point north that it succeeds in Alabama?

PROF. WILLIAMS: I was down in Baldwin county the first day of April, I think, a year ago, and those trees were in full bloom. We have trees growing in Coffee county. I should say possibly 100 miles north of Mobile, but it is a question as to whether it will pay to grow them that far north.

QUESTION: Blooming in April, what time do they ripen?

PROF. WILLIAMS: Those grown by this company will bear the latter part of September. They come in the last week in September, and on up to about the 10th of October.

COL. HUNT: Do you know anything about the hybrid created in Texas between the Satsuma and the Tri-foliata?

PROF. WILLIAMS: Mr. Swingle referred to that in an article he prepared for your Society last year. We are very much interested in hybridizing citrous fruits at our station, and we sent last fall to Washington some crosses where the seed had been planted in forcing houses there under Mr. Swingle's direction, and we are very anxious to learn the results. Of course it will be two or three

years before they come into fruitage. The good qualities in the Satsuma combined with the Trifoliata have given us a very valuable cross, but of course I don't know how far that can be disseminated.

COL. HUNT: Mr. Swingle has issued a bulletin in which he says it is impossible to grow Satsuma on any other stock but the Trifoliata.

PROF. WILLIAMS: Successfully, but you can grow it on a sour orange.

COL. HUNT: The point I want to bring out to these people is this:—That we have got to breed an orange of quicker maturity, of less time between the date of the blooming and the date of fruitage. We can't change the seasons, but we can change the length of time of maturing fruits.

PROF. WILLIAMS: The Satsuma comes on the market at a time when it has no competitor. Two weeks off of the tree, however, they will dry out badly. The rind is very loose and porous, and for that reason it dries out rapidly, but there is a special market now among Chicago people, who are very fond of it. They are packed now in cases holding about 240 fruits, and now there is considerable attention being paid to grading, which of course is always commendable. I think that those oranges can remain on the trees until the first week in January, provided no freeze came along to kill them on the tree. So that tendency they have to dry out quickly can be eliminated as a bad factor by constant shipment, and not having a great quantity on the market at any one time.

Now the type of fruit varies on the same tree and the size of the fruit and the thickness of the rind vary on the same tree. The larger fruit is far inferior in quality to the smaller. In the larger fruit you will find that the

rind has an excess of vegetable matter. It is a fruit that will respond more quickly to commercial fertilizers than any fruit I know of. It is a surface feeder, and cultivation and fertilization control it finer than any fruit I have ever studied. The fact is, I know very little about it, but now that we have a little money to work on those things, we can spend more time on them. I think that this thing of so many different shapes and qualities of oranges on the same tree is going to cause trouble in grading and shipping in large quantities. Its the same way with the pecan industry to-day. I think its going to resolve itself into this and I would like to ask Mr. Berckmans' opinion on it, that more attention will have to be paid in the propagation—that is, take a branch that has the well shaped oranges and good quality, and simply select those buds and let the others alone. Its going to be slow work probably, but will that not eliminate to a certain degree the variability on the tree?

MR. BERCKMANS: It certainly shows that there is a great deal in bad selection, and by the proper selection, that is, selecting the group of branches bearing the more desirable class of fruit, by constant propagation of that respective string we can, no doubt, in time overcome certain physical imperfections in various varieties of fruit. Of course its going to take quite a time to do that, but it is possible.

PROF. WILLIAMS: Another thing. One tree placed here and another one there will show up very differently. Different soils seem to have a marked influence on the quality of the fruit and the character of the tree. There's a vast field in that, but I thoroughly believe in the Satsuma orange.

Another thing about the Satsuma, it is not killed be-

low the bud. If it is killed back it will throw out and bear in two years again. That's been noted time and time again. I think its going to mean a great deal to Alabama horticulture, the extensive planting of the Satsuma orange, especially in connection with the pecan. I don't believe in taking up the heavy planting of a crop, in which there is any question of ruin from failure, because a man might spend an entire fortune on 100 acres, and lose his fortune in a night. I believe in the combination planting, rather than single on a large scale.

COL. HUNT: Are you growing the Satsuma in the nursery?

PROF. WILLIAMS: Yes sir, we are growing them in the nursery and in the open.

One other point. Those oranges of fair quality and size bring 55 cents a dozen in Mobile. Those crates are \$5.00 plus express; so you can see how much money there is in it. By actual count on an 8 or 9 year old tree I counted between 1100 and 1200 fruits, to show how prolific they bear. It is just simply a mass of orange.

CHAIRMAN HUNT: The next paper on the program is "Horticultural Conditions in South Georgia" by Col. Chas. A. Van Duzee.

SECRETARY WIGHT: Mr. President, Col. Van Duzee is detained by the very serious illness of his mother. However, he has sent his paper to be read by Mr. Williams, a member of the Society.

#### HORTICULTURAL POSSIBILITIES OF GEORGIA.

C. A. VAN DUZEE, Cairo, Ga.

This association represents a portion of the world's workers who devote more or less of their lives to a calling that should be one of the most noble, elevating and promising of any of the pursuits by which men earn their daily bread.

It is a great pleasure to be permitted to contribute my small portion

toward the success and profit of this meeting, for I am deeply interested in the progress being made toward a better condition of living among those who are happily permitted to find their occupation upon the land.

The most vital question before the American people today is a solution of the problem of making the home life of those who live upon the farms more attractive and prosperous.

There is something in the heart of most of men who dwell in cities which calls them back to the land, and many do come back, but it is necessary that we strive by every means within our power to prevent the young people of the farms from leaving the country.

Much has been written upon conservation of the natural resources of our nation, but little has been said of the conservation of our children, and yet the future life of this nation and the welfare of the world depends more largely upon this one thing than upon all the rest.

If we can show our boys and girls the deplorable condition of city life it would go far to offset its attractiveness, if we can educate them to a just appreciation of the advantages of country life and can attract and hold them by doing away with much of the unnecessary hardships and by making their daily life more acceptable and happy, if we can show them the nobility of our calling and make them take pride in our occupation, we shall have accomplished much.

In speaking of horticultural possibilities in Georgia, I shall not attempt the use of technical terms or enter into details, for the field is too broad and the time is short, but I have a few thoughts that I wish you to carry home with you and shall first pass criticism on some of those things that are holding us back.

I have in mind a farm any of you can see in a short drive. About the house the earth is bare and bleached by the sun and rain. In the door yard disreputable looking hens are dusting themselves, and indifferent hogs sleeping about. The air is filled with the hum of innumerable flies from the barn yard, which is too near for comfort, health or self respect. The fences are broken and in bad repair. If there was ever any paint upon this house it is gone, and those of the children who are old enough are also gone. If we go beyond into the fields we shall find them worn and washed and we shall see but scant promise of future profit.

Time bids us quickly hasten on and we approach another home. I have seen it from afar, and not many miles from here. Beneath the great trees that grow near this home are bright clouds of color, and the eye is rested by the green of a well-kept lawn. Rose, flowering shrubs and plants are grouped along the lines of well-kept walks and fences. There is room beyond for the orchard and kitchen garden before we come to the barns and outbuildings, and while this house is neatly painted and seems to strive to draw us within its attractive shadows, we will first go into the orchard. Here we find a table and some chairs, and as the owner rises from one of them we note that he has been reading a journal devoted to his work. Here in the grateful shadows he is working out some of the problems of his calling. This man, because of his orchard, and the mind which he has fitted for and applied to his occupation, is amply able to spend a part of his time here

among pleasant surroundings, and is better able to direct those who toil for him with profit to them and himself.

A large part of my sympathy is centered about the small farmer, and it is to him that much of what I am saying is directed.

There are two great mistakes being perpetuated in our Southern farm life. We do not diversify, and we do not farm intensively.

I was much interested in an exhibit of products of a one-horse farm at a recent county fair but a few miles from here, and speaking of it to a gentleman from another part of this State, he told me the story of a family reunion at his home, where forty-two persons sat down to dinner at a table upon which practically everything had been produced from the farm.

Few of us realize the possibilities of the home acre. We are too apt to depend upon cotton to enable us to buy at the store many of the things we could provide ourselves at little cost and of far better quality, and when this habit becomes fixed and the crop is short, it is too late to prevent the result.

Happy is the family who can draw upon its own home acre for fresh vegetables, fruits, nuts and flowers; and who can have pure milk and cream eggs, poultry, home cured meats and pure cane syrup.

There are many small plots of an acre or two about this section of the country, which represent very little money outlay and yet return many times the profit derived from large fields adjoining, and the added health and the pleasure to the family is beyond computation.

I firmly believe the pecan tree to be one of the most profitable things that can be planted upon our Southern lands, and it reaches its highest perfection and returns its largest profit when planted about the home in small numbers, where it can receive the best care and can share in the fertility of the soil immediately about the garden and buildings. Nothing within reach of the man of moderate means who owns his land will pay so well.

There are single trees all through this section that bring their owners over a hundred dollars worth of fruit each year, and at very little cost for labor. No other crop is more safe, sure and profitable and none more easily obtained.

In Grady county I know of half a dozen pecan trees that return each year in fruit alone more cash profit than the adjoining fifty acres of farmed fields. I know of half an acre in another place that returns enough money to support a small family in comparative comfort, and these trees add beauty, dignity and grateful shade and value to the land.

I once had a small farm near here offered to me by the owner who had a better one. It had a pretty little cottage and well-appointed garden, a good stable and poultry yard. The price was \$2,000. I asked the owner if he did not think it too high. He pointed to eight or ten pecan trees in one part of the lot and told me they had paid that year 6 per cent on the price asked, and would pay more each year as they grew older. One great advantage in the crop from such trees lies in the fact that it can be gathered at leisure by the whole family, and as a pleasure rather than a task.

One friend of mine has, in his wisdom, given each of his children a tree for their very own, and it was a good thing to do. Another advantage is that the surplus nuts can be marketed at any time.

The land which supports these trees can be utilized in growing other crops, or will make an ideal poultry yard or a pasture.

Some of these advantages are also true of the pear, peach, plum, persimmon, mulberry and other orchard trees, and it is good business to use the same acre of land for several purposes.

In the planning of the field work it is well to bear in mind that it takes a lot of hard labor to tend to three acres of land for a bale of cotton or thirty bushels of corn, and that there is no profit in the operation, while the bale of cotton or the thirty bushels of corn can easily be grown on one acre with a nice margin of profit, and the man who does this can have half his time left to work out other problems or to enjoy in some other way.

Weeds grow on the surface of the land. If we can deepen our soil so that we have two acres beneath the one on top we not only get rid of the labor of killing those other weeds, but as a matter of fact the added vigor and growth of our crops will further reduce that labor by shading the soil.

A somewhat new idea is gaining ground that our soils contain much of fertility that can be utilized by careful handling and that the annual expense for fertilizer can be very materially reduced by using good judgment in this direction.

We need more knowledge and the application of better business methods. We must strike out boldly from the accepted methods of the past and with judgment and care bring to the farm work new methods that will put our operations upon a more profitable basis.

One of the best farmers I know makes it his rule never to sell anything from his land except finished products.

Beef, pork, butter and eggs take practically nothing of fertility from the farm, and in the production of such finished products the grains are converted into higher priced articles with greater profit to the farm.

It takes time for a tree to grow into profitable fruiting. It takes time for an idea to take form or for an experiment to be worked out, but we must stay on the land during the years, and it adds much of happiness to the daily life if we plant trees and have ideas and plan experiments.

Aside from the food we eat, the clothes we wear and the place we sleep in, the most prized thing on earth is happiness. Happiness comes largely as the reward of work; the knowledge of having accomplished something, and in horticulture we have an endless opportunity to better ourselves and those about us by bringing to our work the best that is in us, and the results will continue for all time, giving happiness to those dependent upon us as well as ourselves, and making possible greater things for the future.

**CHAIRMAN HUNT:** I think we have time for still another paper before we adjourn. If so, that will bring us up to the program for tomorrow morning. I take pleasure in presenting Mr. T. R. Lombard, of Cornelia,

Ga., who will deliver a paper upon "Intensive Orchard-  
ing as Practised in the West."

**MR. LOMBARD:** Mr. President and Ladies and Gentlemen: It is a matter of supererogation to say that it is a great pleasure to address this Society, and that it is rather an embarrassment upon me, a layman, to do so, but my excuse is that I received a letter from our late beloved President, asking me to make an address on the subject of "Intensive Orchard-  
ing as Viewed by a Business Man," he knowing that I had given the matter a great deal of attention, and I took his request as a command.

I want to say, before I read my paper, that I feel as though possibly I may hurt the feelings of some of my fellow-orchardists. They may think I am hypocritical, fault-finding, but in my heart there is no feeling of that sort. What I say will be mere platitudes perhaps, but it is only by the iteration and reiteration of platitudes, that they sink into our minds and become truths.

#### INTENSIVE ORCHARDING.

I find that I am down on the program for a talk on "Intensive Orchard-  
ing as Practised in the West." It will be found, however, that my subject should have been more properly labelled, "Intensive Orchard-  
ing as it is not Practised in the South." There is no wish on my part to criticise the methods of the Southern orchardist. I merely want to set forth for his consideration the subject as it strikes a business man who has had opportunities to study it in other parts of the country and show why, in a section where Nature has done all that could be asked of her to make fruit growing a successful occupation, many of those who have gone into it in Georgia have failed.

During the past seven years I have had opportunities to see and compare the methods of the different orchardists of the State in the treatment of their fruit trees and within the past few months I have personally visited nearly all the orchards, large and small, with the result that, that which I have heretofore entertained as a theory has been proved to me as a fact.

I have everywhere been confronted by the inevitable conclusion that the great trouble is that the peach growers of Georgia, as a rule, are not

giving to their orchard management the same business brains that they are applying to other affairs. The condition of the peach business as I have found it in Georgia, during my recent trip, is not encouraging. Here is an orchardist who refuses to spray or fertilize, because he did not make much money last year; and here is another who will not spend a penny on spraying or fertilizing, because, while he did make money last year, he does not propose to risk losing any of it again by spending it for the good of his trees, for fear he will never get it back.

In nearly every peach district of Georgia you will find men who are making money and are satisfied with what their trees are doing, and you can also find for every one such man a dozen others who had originally equal chances for success, who have not made a cent and never expect to.

Either the peach business pays in Georgia, or it does not. Dozens of men are pulling up their trees in emphatic affirmation of the fact that it is a losing game, and yet, the strange part of it is that right next door to one of these discouraged orchardists you will find a man whose carefully kept accounts demonstrate that he is making more money in peaches than he could get from the same land in cotton or corn.

Let us consider the orchard situation as it exists in Georgia today, as compared with the orchard business of the West, taking for comparison a well known Colorado peach district.

According to the best authorities there are about 14 million peach trees in Georgia. Dividing the number of trees by the number of owners we find the Georgia orchards average 100 acres in size. Investigating in the Colorado district we find the average orchard in that section is ten acres.

Coming back to Georgia and figuring on the basis of the largest crop ever shipped, 6,300 cars, and making a generous allowance for fruit shipped by express, used in canneries and for which no cars were furnished, we get the rather astonishing and humiliating result of an average of less than one-fourth of a crate per tree. Inquiry in Colorado again brings out the fact that the average yield of an eight year old tree there is eight boxes, or a little over four crates to the tree.

Reducing this to cold figures, it means that the Colorado man is shipping more fruit from his ten acres than his Georgia brother ships from 100 acres. This is an astonishing discrepancy and calls for an explanation. When we have investigated market and labor conditions, climate, water and all natural conditions we find that Georgia compares favorably with Colorado.

The real explanation is that the Colorado man is running his ten-acre orchard on up-to-the-minute principles, while the Georgia man is growing happy-go-lucky peaches, just as his grandfather would have done and with the same generous prodigality of acreage. The proof of this statement lies in the fact that whenever the Georgia man has used Colorado methods in running his orchard he has obtained Colorado results.

As an example of what can be done in Georgia I want to give you the record of Mr. C. J. Hood's 100 acres near Cornelia. In the six seasons since the first crop was gathered there have been paid the cost of the land, all improvements and all expenses, and in addition the owner has

had profits of \$24,302, or at the rate of \$243 an acre for the land in orchard, amounting to \$40.60 a year, and this with one crop failure and one almost failure out of six crops.

As I am well acquainted with the orchard in question and know that it is undoubtedly a fine sample of the best methods of intensive orcharding, and this orchard lies in a region surrounded by many other orchards, some of which, while equally well favored as to all that nature can do to make success are yet comparative failures, simply because the owners fail to give the kind of care that would change failure to success.

The truth is that, while 6,300 cars from 14 million trees shows an average of one-quarter crate to the tree, the quarter crate to the tree was not evenly distributed over 14 million trees. If it had been, it would look discouraging indeed for the peach business here. I have seen fruit shipped from two adjoining orchards in Georgia, where the variety of the fruit was the same, the age of the trees equal and all natural conditions identical, and one orchard shipped two crates per tree, while the other shipped less than one-tenth of a crate per tree.

A few years ago a gentleman came to Georgia for the purpose of investigating the orchard conditions here. He had previously posted himself thoroughly on the situation in the West and knew that land there adapted to the orchard business would cost from \$400 to \$600 per acre. He convinced himself that the natural conditions here were as favorable for profitable growing of fruit as they were in the West, and that if he same intensive methods were used the results would probably be quite satisfactory. He purchased a property for about \$25 an acre, on which there were a few hundred trees already planted, but in a neglected condition. Last summer I had the pleasure of watching the gathering of his first crop. He had given his orchard intensive treatment. The soil had been put into fine condition by plowing under leguminous crops. He had fertilized early in the season, four pounds to the tree, with a formula balanced just right, enough nitrogen to give the size to the fruit and a flourishing condition to the foliage, but not enough to make soft peaches; enough potash to color the fruit a rosy red and make it firm for shipping, and enough phosphate to balance the whole, making vigorous tree growth and setting new buds. He had sprayed for curculio and scale and to overcome the tendency to brown rot to which the old part of his orchard was predisposed because of neglect. He had given the ground shallow cultivation up to crop time. When he gathered his crop he had expert packers put up his fruit in the best known way, with attractive labels on certain crates, and he sold his peaches at \$1.75 a crate f. o. b. There was no cull heap of decaying fruit near the little packing house, but the culls were as fine as many orchardists produce for shipping fruit, and he shipped them in crates to nearby markets and sold them at \$1 per crate.

This man merely brought sound business sense to his undertaking. He planted only as many acres as he could afford to care for by the most intensive methods known. His fertilizing, cultivating and spraying expenses were expected and provided for in the first instance. He is now

looking into the subject of orchard heaters to fight frost, and I do not doubt he will make a success of that, too, if he attempts it.

He can truthfully say that he is doing for his orchard everything which science and experience have demonstrated will contribute to the good of his trees. There are few orchardists in Georgia who can say as much and the reason is that the Southern orchardist is too often an orchardist by accident.

Undoubtedly the great cause of failure can be traced to the indiscriminate planting of large acreage under the impression that all a man had to do was to plant a lot of trees and just let them grow.

Swept off his feet, a few years ago, by the reports of the success made in peach growing by a few neighbors, without giving the question proper thought or investigation and owning boundless acres too poor for cotton and corn unless liberally fertilized and well cultivated, he dedicated these to his peach orchard. He regards his orchard today as a side issue. When he can spare the time he gives it an occasional cultivation. Pruning, worming, spraying for diseases, receive spasmodic attention. He takes no thought of the feeding of his orchard, so that fertilizing does not enter into his plan at all. Occasionally, when all natural forces combine to produce for him a crop of fruit, he harvests, packs and ships it in the same haphazard way that he has treated the subject from the first, and then if he happens to hit the market right, he pats himself complacently on the back and congratulates himself upon his fine business ability. If, however, it turns out that his returns are low or nil, he blames everything and everybody for the result, and as the orchard is the only thing on which he can revenge himself, he proceeds to give it greater neglect or pulls it up by the roots and goes back to planting cotton and corn.

It is because of these conditions that Georgia today is averaging a quarter of a crate per tree. Many men are cutting down their trees this year, and I have invariably found that their orchards had never been fertilized or summer-sprayed, and most of them have never been sprayed for scale. I rejoice in the destruction of these trees. It makes so many less of the kind that are a disgrace to the industry. On the other hand, wherever you find a highly profitable orchard, spraying and fertilizing have been the rule, and careful cultivation.

There is not a man in Georgia who would take the average red hillside and expect to raise a good crop of corn or cotton without giving it careful cultivation and liberal fertilization. Such a man would be a fit subject for ridicule in any community. And yet he asks that same red hillside to produce for him a bountiful supply of peaches yearly, altho if he would investigate he would find that it requires two or three times the amount of plant food to produce peaches that it does to produce cotton or corn. Yet he asks this same soil to produce good, healthy trees and fruit and refuses to furnish either care or food to enable it to do so. No man would be so lost to all reason as to expect success if he applied the same methods to his general farming, his cattle or his hogs, that he does to his orchard.

And, now, a word of warning. Another craze has struck the country,

and now apples and pecans are being planted, with often the same disregard for results that has characterized the planting of peaches. It takes no prophet to predict that in a few years there will be another lot of disgruntled orchardists, who will be digging up trees because their hope of getting something for nothing has been frustrated by indignant nature.

It seems a great pity that it should be necessary to make such an address as this. The facts are so self-evident that argument should be unnecessary. Why a tree, because it is a tree, should be expected year after year to produce more food stuff from an acre of ground without care or nourishment, than is expected from plants on that same acre is to me, a mystery that can only be explained on the hypothesis that man is too stupid and careless to give attention to anything that does not seem to vociferously demand it. He knows he must work and care for and feed a plant, and at the last if he is fortunate he may get from \$50 to \$75 returns from his acre, and that if he neglects it he will get nothing. On the contrary, however, his peach tree is there, and although it may be poor and weakly, it grows a little, it struggles to put forth leaves and blossoms and, occasionally when all the conditions are favorable it bears some fruit, all this in spite of man's neglect, and so he takes the chances, and Georgia peaches average a quarter of a crate to a tree, because he is among us.

There is no mysterious secret, by the use of which the initiated can make money, while his neighbor is doomed to failure. The whole art is open to the world, and every grower who will, can succeed. Intensive orcharding is the keynote to success. Make every tree in your orchard a good, sound, healthy tree. Don't plant more trees than you can conveniently care for. Don't expect your fruit to bring as good price as your neighbor's if it is specked with brown rot, stung by curculio or covered with scab. Don't expect buyers to pay as much if you are careless in your packing. You must give good measure and well grown, well packed goods if you want to be a top-notch.

Go to our Government, where you will find full and explicit information on all these points, carefully prepared and printed documents issued and sent without cost to all who ask for them. Go to our State Entomologist, a man who has made, and is making, history in his war on pestilential insects, enemies of our orchards, and finally, go to your successful neighbor and you will find him only too willing to help you, for he is glad to have your orchard made thrifty and profitable, for he is thereby reducing the menace to his own trees from contamination of a diseased orchard.

There are many owners of large orchards in Georgia, who are fully aware that they have neglected their orchards and that such neglect does not pay, but their defense is, that while the spirit is willing, the pocket is weak. To such men I would say that the logical course is to determine, first, how much money is available for the care your orchard, then figure how much it will cost you per acre in your locality to give the intensive care, and then cut your acreage down, either by sale, or with an ax, to the number of acres you can afford. 5,000 trees, well

cultivated, fertilized and sprayed, will give far more net profit to you than 20,000 trees indifferently cared for.

**MR. BEROKMANS:** Mr. Lombard has given us good advice, and I want to see some of our members just put him right on the stand and cross question him. He has attacked us pretty severely, but justly so. There are some of you here, no doubt, in this audience, who may not agree with him, but I for one, as a fruit grower, especially in the line of peaches, must say that Mr. Lombard has touched a keynote in his paper tonight. I wish that more of our members had the courage to stand up and assail our growers as Mr. Lombard has. He certainly ought to have the endorsement of every grower in the entire South. It is our duty to stand by him, and help him out on the line of discussion he has entered into here tonight, and I want to see more of our members get up here and express themselves on the line Mr. Lombard has; if they agree with him, let them say so; if they don't, assail him.

**CHAIRMAN HUNT:** I not only think the paper most excellent, loaded with much information, but it was so delightfully entertaining from beginning to end.

**COL. WADE:** I happen to know all about that man. I know about that orchard, and I shouldn't wonder, if he was giving me a hit on a part of mine. He came up there, bought 18 acres of my orchard, paid \$2600 for it; he went to work on it, and he certainly played havoc with those 18 acres, but he took \$4500 off of it before the year was out, and he knows a little something about what he is talking about. I know I am guilty in some respects; I have not treated my orchard right, but most of my neighbors know the reason why. I started in with fifteen partners in the business, and the first thing I knew they were running turpentine all over God's country and a

part of Florida, and so I made up my mind to buy them out. We had 300 or 400 acres in orchard, and instead of having a million or two back of me, I had to wait, and it made a heap of difference. I believe I know how it ought to be done. I know Hood's orchard that he quotes. Hood was perfectly unconscious that it was going to be mentioned here tonight, and he was perfectly unconscious that it was in the Constitution the other day, and that fourteen other papers had clipped from that paper. He is President of the First National Bank, and he has a habit of putting everything down in books. A man offered him this orchard for \$500. He took it, went to work on it, and off of five acres he took \$750 the second year, \$1700 the next year, \$2500 the next, and so on. It shows that intensive cultivation, putting in fertilizer (he had plenty of money, and he proposed to try it out) will yield results. Mr. Hood's orchard is a success, and right by the side of it are orchards dying from scale and lack of care and cultivation.

Now some of us probably ought to go into our orchards with the ax. Some of us get the wrong tree planted. One of our neighbors took out 10,000 trees. We ought to take them out and burn them, lots of them. If we will practice in Georgia intensive orcharding there is no question about the fact that Georgia will be the peach State of the Union. There are three little counties in the western part of Michigan, that send out more peaches than the whole State of Georgia, through intensive cultivation. If we would practice that in Georgia, instead of a quarter of a crate per tree we would take out four crates per tree, sixteen times as much, and it makes all the difference in the world in the cash ac-

count. I am so glad that my neighbor has brought these points out.

MR. GREER: Gentlemen, I am called away tomorrow and cannot be with you. I am sent here by the Tifton Chamber of Commerce to ask that this Society meet in Tifton next year. We have a welcome for you that will at least approach that which Thomasville has given us, and I assure you we will do all we can to make it quite as warm. I desire that the Secretary will enter Tifton as a contestant for this honor next year.

Chairman Hunt stated that this Society appreciated this invitation, and it would be given consideration in due course.

Mr. Wight called attention to a sample orchard heater—the Underwood—which was on exhibition for the inspection by the members.

At 8:00 p. m. on motion the evening session was then adjourned. At nine o'clock a hundred guests, including many charming ladies of this city, sat down to a banquet at the Masury Hotel. Hon. W. I. McIntyre, on that occasion, acted as toast-master, and he was never more entertaining nor brilliant, than at that time. His introductions of the various speakers were very appropriate and his sayings were keenly enjoyed by every one present. Each speaker responded graciously and gracefully when he was called upon and an elaboration of their talks would prove interesting. Those responding were Mr. J. H. Merrill; Col. Hunt, of Eatonton; Mr. John Greer, of Tifton; Prof. Craig, of Cornell University; Col. White, of Canada; Mr. Simeon J. Drake, of New York; Col. I. C. Wade, of Cornelia; Dr. A. D. Little and Mr. W. C. Snodgrass.

Col. Wade paid a very beautiful tribute to the ladies

when he presented Miss Culpepper with a North Georgia apple, designating her Queen of the occasion and hoping that, like Atalanta, she would get with the apple, whatever she would wish.

The following is the menu for that occasion:

Chicken Consomme		
Gerkin Pickles		Dressed Celery
French Rolls		
Young Roast Turkey with Dressing.		
Cranberry Jelly		Sliced Tomatoes on Lettuce
Fruit Punch Maraschino		
Rosette Wafers		Saratoga Chips
Thomas County Pig, Barbecued		
Stuffed Egg in Lettuce Nest		
Strawberries		Whipped Cream
Golden Nut Cake		
White Mountain Layer Cake		
American Cheese		Salted Crackers
Mixed Fruit		Coffee

## MORNING SESSION—FEBRUARY 8, 1911.

The morning session was called to order by the Chairman, at 9:30 a. m.

CHAIRMAN HUNT: Is it your pleasure that I appoint the Committees on Resolutions and Auditing Treasurer's books?

MR. BERCKMANS: I move that these appointments be left entirely with the Chair.

This motion was seconded and carried.

CHAIRMAN HUNT: I will appoint as the Committee on Resolutions: Col. John P. Fort, of Athens; Col. John W. Greer, of Tifton; Col. I. C. Wade, of Cornelia.

I will appoint as the Committee on Auditing Treasurer's books: Mr. T. R. Lombard; Mr. B. Von Herff; Mr. W. T. Gaulden.

The Chairman then read out the following standing Committees:

On New Fruits: Prof. T. H. McHatton, Athens; L. A. Berckmans, Augusta; J. B. Wight, Cairo; H. R. Staight, Demorest; Herbert C. White, DeWitt.

On Synonyms: R. C. Berckmans, Augusta; H. B. Chase, Huntsville, Ala.; G. H. Miller, Rome, Ga.

On Ornamental and Useful Trees: B. W. Hunt, Eatonton; Prof. Alfred Akerman, Athens; H. L. Boone, Valdosta; B. W. Stone, Thomasville.

On Vegetable Culture: John P. Fort, Athens; H. L. Long, Leesburg; John A. Cobb, Americus; Charles S. Bohler, Augusta; R. H. Black, Cornelia.

On Vegetables and Fruits and Transportation of: I. M. Fleming, Atlanta; George White, Jr., Sparta; T. R. Lombard, Cornelia; A. M. Kitchen, Baldwin; I. F. Murph, Marshville.

On Legislation: W. H. Felton, Jr., Macon; Judge H. L. Long, Leesburg; Jno. T. West, Thomson; M. J. Yeomans, Dawson.

On Biology: E. L. Worsham, State Entomologist, Atlanta; A. C. Lewis, Assistant State Entomologist, Atlanta.

COL. WADE: Mr. Berckmans has suggested an idea that I believe is a good one, and that is that we have another executive officer, of our organization—a vice president—independent of the congressional-vice-presidents. According to our Constitution it would take a three-fourths vote to change it, so as to admit of this new executive officer. Therefore I rise to make a motion that we vote now upon changing our Constitution, that we may be able to add another officer, a general vice-president, to our list of officers. It does seem to me that we need it, and I know of no other organization that has no vice-president. Therefore I move that we change

our Constitution, that we may add to our regular officers a vice-president.

This motion was seconded and carried.

The Chairman then presented Prof. John Craig, of Cornell University, who delivered the following interesting address before the Society:

#### IMPRESSIONS OF A NEWCOMER.

It is my pleasure and privilege to come among you, not merely as a visitor, but as brother fruit grower. A man can hardly claim residential privileges unless he has really associated his interests with the soil in some tangible way. I know of no more effective manner of doing this than by planting a tree; for the man who does this actually ties himself to the ground. It fixes him. He becomes attached to the plant inhabitants of the soil, and the horticulturist with the right ideals must have an affectionate regard for the occupants of the land, for those organisms which are directly dependent upon the soil for their daily sustenance.

While my personal interests in Georgia fruit growing are rather narrow, my general interest is wide. In fact, as wide as the boundaries of horticulture. It may not be without point or interest to you to know that my earlier proclivities in horticultural lines were vastly stimulated by the worthy example of the man who, for thirty-four years, acted as the chief executive of this Society. I therefore take this opportunity of presenting my warm contribution to the tribute which you are properly according this distinguished citizen and eminent horticulturist, who has for so many years guided, aided and energized the horticulture, not only of Georgia, but of the whole South. Prosper Julius Berckmans represents a type of horticulturist now almost wholly extinct. He was at once a naturalist and a fruit grower, a scientist and a business man. His example and his aid was of inestimable value to the horticulture of the South, and his record should stand as an ideal for the young men of the generation to come.

If a personal allusion may be permitted, I may say that I was attracted to Georgia by its pleasing climate, its attractive stretches of tillable soil so admirably adapted to a large variety of farm and orchard products. It is a trite saying that man likes variety in life. No climate is sufficiently perfect to be completely satisfying as steady diet. The majesty and energizing influence of a Northern winter in its varying aspects is quite as attractive, to many, as the balmy zephyrs and warm sunshine of the South; but both are likely to pall when continually in evidence. There is, therefore, a demand for change, if not a need for this, and so, following the example of the birds and indeed of the luxurious Romans, we would nest as conditions favor in different parts of the country. This is one reason for my accepting the privileges of a cultivator of the soil in your midst. Another reason associates itself with a more sordid

side of life, still a necessary one, the money-getting side. While necessary it may not be, and sometimes is not, agreeable.

My own belief is that Georgia possesses, perhaps unsurpassed opportunities in farming, and, having horticultural proclivities, I cannot refrain from saying, in fruit growing. It is undoubtedly presumptuous on my part to offer advice on such limited acquaintance with your natural conditions, and the resources and possibilities of your soil and climate. Nevertheless, we learn by travel and study. He who uses his eyes and intelligence to their fullest possibilities may gather lessons to advantage to himself, and possibly to his brethren.

It is apparent that there are certain fundamental problems common to all parts of the country. Such a problem as the conservation of soil fertility presses on practically all parts of the country. In no section is it of more importance than in the South.

The growing of the crop adapted to the locality is another phase of the horticultural and agricultural problem which often determines success or failure. It is useless waste of energy to attempt a crop in a locality so unsuited that the product will in no wise compete with that of another region more advantageously situated. All this means the application of intelligence to the problem in hand. It means the influence of man. We hear of shining successes in fruit growing or in farming here and there. When these are examined, when the situation has been studied in all its aspects, we find that the real discovery has not been so much unique natural advantages as the man behind the project. Some one has directed the campaign. Of course we admit that "lucky strikes" occur now and then, but the reward of success is usually measured in terms of brains and their application.

It is most gratifying to note in this connection that no part of the country is making greater progress in the advancement of agricultural education than the State of Georgia. This State stands out as a notable example of the will and the ability of the people of the open country to co-operate with the legislative bodies in establishing education upon a thoroughly systematic and logical basis. In this connection, it is my pleasure to congratulate you on your progress and your prospects.

But I am to say something to you on the horticultural possibilities in Georgia. I have had some opportunity of gauging these during periodical visits covering a period of some ten years. During this time, I have visited most parts of the State, and seen the results of well directed as well as ill directed effort, and shall make bold to offer some suggestions as to the lines along which horticultural effort might properly be directed in the future.

1. *Apple Growing.* Time was when it was thought that apple-growing was confined to the cooler regions of the Northeast, including the States surrounding or adjoining New England. But the apple region has extended from the East to the Pacific boundary on the West, and from the North to the elevated regions of the Gulf States. There are great consuming centers in the South, increasing in consuming capacity every year, which should be supplied with home-grown apples. The hilly lands of

North Georgia are admirably adapted for the production of high-class summer and winter fruits. The climate is as favorable as the soil. In the cultivation of orchards in these localities, I would not advise the growing of late summer and early autumn varieties, for in my judgment, these would meet disastrous competition both in Northern and Southern markets; but it seems to me that there is a unique and very promising opportunity for the growing of early summer and late winter type of apples, such as the Red June, and possibly Yellow Transparent, representing the first-class, York Imperial and Winesaps, representing the second. Recently there has come to my notice apples grown in that locality which were as fine, both in appearance and quality, as any which can be produced in the country.

2. *Peach Culture.* Georgia has done a great deal to advertise the United States as a land in which the finest of the stone fruit may be grown in high quality and great abundance. But peach culture has struggled against at least three serious difficulties. These are (a) brown rot and insects, (b) late frosts, (c) marketing troubles. As an outsider and one knowing comparatively little of the workings of this industry, it is plain to me that the outlook has vastly improved. With the results of the splendid work of Scott and others in the use of lime-sulphur as a summer spray, we have a remedy which will enable us to hold these serious enemies in check, and success will come largely in proportion as perseverance and intelligence are used in applying this remedy. Again, the results of our fruit growing friends of the intermountain region in combating the destructive effects of late frosts by the use of devices which warm the atmosphere, have suggested to all parts of the fruit country where frosts, instead of freezes are the injurious agents, a possible means of circumventing this source of loss. Methods of orchard heating are rapidly becoming systematized and approaching the feasible stage. Peach growers of Georgia will do well to keep up with the latest there is to be gathered on this subject, and will also do well to institute small experiments on their own account.

The third feature, bearing on marketing troubles, has been taken hold of by your progressive growers in an energetic and businesslike manner, and the co-operation of the growers in marketing of orchard products is one of the bright spots in the horticultural history of your State. The feature of standing together and working for mutual interests is the most important of all.

3. *Fig Culture.* I place this in the list in a tentative way. I raise the question, what of fig culture? What are its prospects? Here we have a crop which under favorable climatic conditions is a very profitable one. It is a crop which appeals to me. It is one which the investor need not wait an interminable period for a return on his investment. On the other hand, the fruit is perishable and, therefore, requires prompt attention in the handling. There are, however, in my judgment, large possibilities for the development of a fig growing enterprise associated with the conserving of the fruit, either in the candied or canned form. This fruit is capable of being much more widely exploited than is the case at the present time.

Is not fig growing a subject worthy of a demonstration by your State Experiment Station aimed to elucidate its commercial possibilities?

4. *Pear Growing.* This is an industry, from the casual observer's standpoint, appears to be falling into disrepute in many sections of Georgia. From the standpoint of the pear grower of the North, who is accustomed to regard pear blight as an enemy which must be treated with the utmost rigidity and severity, the *laissez faire* methods of the Georgia grower seem altogether too easy. The only way in which the Northern pear grower can expect to maintain his plantation in a healthy, profitable condition is to cut out and destroy the blight as it appears. This is also the experience and the practice of the best growers of the Pacific Coast. I make bold to state that my belief is strong in the possibilities of pear growing in Georgia, provided the grower appreciates two things: first, the necessity of practicing sanitation to eliminate pear blight, and second, the fact that the bearing pear orchard makes a heavy and continual draft upon the soil, and that provision for maintaining the soil fertility must be made, a provision fully equal to that demanded by other farm crops.

5. *Pecan Culture.* In this field, I may speak from personal experience. The expansion of pecan orchards in South Georgia and North Florida may properly be said to be phenomenal during the past five years. Perhaps the expansion has been greater than warranted by our knowledge of the possibilities of this crop. It is unquestionably inevitable that some enthusiastic and perhaps poorly informed persons will fail, and meet serious loss. These failures can probably be ascribed to insufficient capital, lack of knowledge, and perhaps lack of business ability and experience. It is fair to say that those who are now investing in large pecan orchards are engaging in speculative enterprises to a considerable extent; for the industry is too young to warrant any one claiming full knowledge of its possibilities. My own faith in the future of the industry is strong, or I would not have embarked so heavily; for this is not a case where the joy of mere speculation is the attractive feature. As in other phases of orchard work, undoubted success will reward the grower in proportion as intelligence, skill and perseverance are applied to the problem in hand.

May I suggest one phase of the problem of land management in Georgia, which from my point of view, is capable of large improvement? I refer to the common practice in the use of fertilizers. It does not appear to me that the average fruit grower and farmer have adequate appreciation of the role of humus in relation to plant food. I might have said the role of humus in relation to the release of plant food, and had I done so, this would have expressed the idea more forcefully. I can say release advisedly, because most of the soils contain in themselves enough mineral foods to grow satisfactory crops, either of farm produce or orchard produce, if we make these foods available. It appears to me that the Southern grower as well as the Northern grower is much too prone to lean on the fertilizer bag for quick results instead of supplying his soil with potential plant food in the form of decaying vegetable matter. Most of us are aware of the important mission of humus, most of us know that it is a conserver of moisture, that it provides a home for nitrifying bac-

teria, and in this way aids in the rendering available of the mineral food of the soil; but few of us keep this vastly important principle sufficiently incorporated in our practice. It is a principle which obtains in soil culture in all parts of the country. It has undoubtedly greater force in the South where soil activities are more pronounced than elsewhere, but the question arises, is it recognized and has the application of the principle more general use in the South than elsewhere? If I succeed in leaving no other thought with you than the thought which embodies the importance of maintaining an ample store of humus in the soil by the growing and turning under the green crops, and if that thought finds any response in your practice, I shall feel that these minutes have been well spent.

COL. I. C. WADE: In speaking of pear blight, Prof. Craig, aside from his paper, stated that they could control not only pear blight, but apple blight; I would like for him to state how they control the apple blight.

PROF. CRAIG: Both apple and pear blight have been controlled in New York State by cutting out, during the growing season, and more particularly at the close of the growing season, every infested portion of the trees. It looks like a big job; it is a big job at the outset, but, as the infected portions are cut out the disease lessens each year, and you will come to a time (we have reached it in three years in working on the same orchard) when there is practically nothing. Our first experiment in this line covered an orchard of 15 acres about six miles from our college, and a man was put into that orchard during the summer, provided with a ladder, sack, knife, and disinfecting liquid which can be bi-chloride of mercury or copper sulphate, and he was instructed to cut it out, and not leave a particle of diseased wood in the orchard. Where the disease appeared on branches or in the forks of the tree, it developed a canker type; it was cut out and painted with Bordeaux mixture; and so on each year the same thing was done. That orchard is in a healthy condition and the blight can be properly said to be completely and efficiently controlled. It is likely to be re-

infected from time to time. The fact that you have stopped the blight now does not of course mean that it won't return any more.

COL. WADE: We do that.

PROF. CRAIG: It is nothing new, except that sometimes we don't realize the necessity of complete and thorough work.

MR. VON HERFF: It must be considered that the disease, pear blight, is very much more virulent in the South than in the North. We grow pears in New York State, in spite of the blight, that it would be quite impossible to produce here. The disease is less virulent than it is here, and I doubt very much if the process referred to would be best in the South. In fact, I can cite an example. About ten years ago the same method was tried in North Carolina, and in a most thorough manner. We followed up every twig, and cut out everything and painted afterwards, and the blight continued just the same as before, and did as much injury. We did find, however, that not cultivating so as to prevent the suckers from coming up, and prevent a sappy growth contributed greatly to reduce the blight. People who didn't pay much attention to their pear trees were the best off, and those who paid the most attention to them were the most affected.

PROF. CRAIG: I was exactly of Mr. Von Herff's opinion ten years ago. I have seen the same effort expended on attempting to control pear blight, that he describes, with practically the same results. We miss one fundamental point. We carry on our work during the summer, but we do not make that careful scrutinizing examination that is absolutely necessary, in the fall of the year, to cut all the diseased pear twigs which maintain or carry the germs over to the next season. If you clean

them at that time you have no germs to start the next season. That is the important time, the complete eradication of the disease at the close of the season.

MR. LOMBARD: In cutting out these diseased trees, do they sterilize the tools? If the man cuts out the blight with a pruning knife, when he goes to another part of the tree or to another tree, should he not sterilize his knife?

PROF. CRAIG:—Certainly.

MR. BLACK: Regarding those pieces of bark, I would like to ask whether the man should not try to save the bark, and carry it out of the orchard?

PROF. CRAIG: Most decidedly. I read an article some time ago, in which it was claimed by a man working in California for the Government that, if the bark was dropped on the ground, and dried in the hot sun, the germ would die. That may be true, but California has one condition, and Georgia is another proposition. You have your dry season in California, and any thing that lays out for three weeks under a California sun is pretty nearly dead. That is an entirely different story here.

MR. VON HERFF: Can you give an idea of the cost per tree of adopting your method?

PROF. CRAIG: \$1.50 per day for the man's time.

CHAIRMAN HUNT: What do you do with the neighboring pear orchards?

PROF. CRAIG: Of course you want to get your neighbors to co-operate if you can, and all of you fight the blight simultaneously, but whether you get them to co-operate or not, you have got to fight it. Now in the San Jose scale or brown rot that's true—you have got to have your neighbors to co-operate—but in this case I don't think one should give up the struggle simply be-

cause his neighbors don't start in with him. If he makes good the neighbors will follow the game.

PROF. T. H. McHATTON: Is it your opinion that blight will live on small twigs all winter in this section?

PROF. CRAIG: I would not pass as an authority, but it is my opinion that it does. I would not say positively.

SECRETARY WIGHT: I think, as pear blight is a very important point, a statement of an effort to control it might be of interest here.

MR. BERCKMANS: The Board of Entomology has been carrying on some very interesting experiments for the past five years in an orchard over in McDuffie county, owned by Mr. John D. West, and I understand that Mr. Lewis, of the Entomological Board, has just made a trip over there, and he has some interesting data. I would like to see if we can't get a statement from him as to what has been the result there. The orchard has come under my close observation, and I have noticed a decided improvement, in the general condition of the trees and the production.

MR. STUCKEY: I wish to state that Mr. Lewis is not feeling so well this morning, which accounts for the fact that he has not yet come in.

SECRETARY WIGHT: I think a statement of an effort to control the pear blight in this section might be of interest. Some eight or nine years ago I solicited the Department to attempt to control the blight in an orchard of 3000 trees I have at Cairo. The Department tried for three years to control the blight in this orchard and failed. There is as much blight there now as there is in a neighboring orchard, where no effort has been made to control it at all. I believe the trouble is, Mr. President, that it will be impossible to control the blight

in this section until we have inspection and cutting out of the blight from every tree in the section. We will have blight as long as we have pear and apple trees unless we come to that. Prof. Craig spoke of the neglected condition, in which our pear orchards are in this section. They are neglected, Mr. Chairman, simply from the fact that we find that when we cultivate them, and fertilize them, and stimulate growth, we stimulate blight to such an extent that it kills the tree. We have neglected them for the simple reason that the more we neglect them the better they do.

PROF. McHATTON: Do you prune those trees at all?

SECRETARY WIGHT: No, except to cut the limbs out of the way of plows.

PROF. McHATTON: Ordinary pruning does not increase the blight?

SECRETARY WIGHT: No, sir. We prune them when we are trying to control the blight; otherwise we do not.

CHAIRMAN HUNT: We will next hear from Prof. H. P. Stuckey, of the Georgia Experiment Station, on "Plum Wilt and Black Rot of Tomatoes."

Prof. Stuckey, after expressing his regrets that Mr. Temple of the Experiment Station was not able to be present, delivered two separate papers, the first on "Plum Wilt," and the second on "The Blossom End Rot of the Tomato," both of which follow in the order in which they were presented.

#### THE PLUM WILT.

H. P. STUCKEY, Horticulturist, Georgia Experiment Station.

Plum wilt is comparatively a new disease, having been observed first at the Georgia Experiment Station and in that vicinity about 1903 or 1904. Some observations on this disease were made and published by Prof. H. N. Starnes in bulletin No. 68, of the Georgia Experiment Station. While he drew no conclusions, he was of the opinion that the disease was of bacterial origin.

Following Mr. Starnes, Prof. T. H. McHatton took up the work on this disease. However, he did not have sufficient time to complete his experiments, and therefore drew no conclusions.

A little more than two years ago, Mr. J. C. Temple, the Station Bacteriologist, and I outlined experiments for work together on the same disease.

Although the work is still in progress, we think the results up to date are worthy of being reported upon.

#### THE NATURE OF THE DISEASE.

The disease attacks Japanese and hybrid plums mainly. However, the native plums are not altogether exempt. In some localities, it has made the growing of Japanese and hybrid plums almost impossible.

The outward symptoms are readily detected. In the early spring the trees put out healthy, vigorous leaves. The first outward sign of the disease is the sudden wilting of the foliage of one or more of the branches. The leaves wilt almost as suddenly as though the branches were cut off. In two or three days they dry, and in a week or ten days the leaves drop, leaving the limbs bare. Sometimes the whole tree will wilt and die suddenly. At other times only one limb may be attacked at first and the disease spread, limb by limb, until the whole tree is dead. Again only a few branches of the tree will die the first season, and the remaining branches die the second season.

The tree, when once infected, seldom if ever recovers, and few survive the second season. The disease often appears in the early spring when the leaves are no more than one fourth grown, and continues to wilt trees until late in the summer.

This sudden wilting of the foliage does not necessarily mean that the disease appears suddenly, for a close examination of the tree will often reveal the fact that it is diseased for some time before the foliage wilts. This disease seems to attack first the cambium, or inner bark, so that the bark on diseased trees is found to be slightly shrunken. If this shrunken bark be stripped off, the darkened cambium layer beneath will show the presence of the disease. This darkened cambium spreads with the spread of the disease and as soon as it girdles the limb the foliage of that limb wilts.

#### DISTRIBUTION OF THE DISEASE.

In order to learn something of the distribution of the disease, we sent out 150 circular letters with return postal cards, asking questions concerning the malady. The letters were sent to prominent horticulturists, nurserymen and orchardists of Georgia, and also to several other Southern States. From the 150 circular letters sent out, 66 replies were received. Fifteen of these replies gave information regarding the ravages of the disease in the different localities. The other fifty-one replies showed no familiarity with the disease.

In Georgia, the disease was found near the following places: La Grange, Warthen, Pomona, Marshallville, Bullochville, Fort Valley, Montezuma, Oconee, Augusta, Atlanta, Fort McPherson, Griffin, Orchard Hill

and Concord. Judging from this distribution, it is evident that the type of soil has little effect, if any, on the disease.

Replies from California, Florida, Louisiana, Missouri and Texas indicate an absence of the disease in those States. However, so few letters, were sent to those States that it was impossible to make a thorough canvass of conditions there.

In addition to the distribution in Georgia, the disease was located in the following States: North Carolina, South Carolina, and Alabama. A more thorough canvass might show the disease to be more broadly distributed.

#### DISEASE UNKNOWN TO JAPAN.

In order to ascertain whether the disease is indigenous to America or whether it accompanied the Japanese plums from their native home, we wrote Director N. Matsui, of the Agricultural College, Tokyo Imperial University, Komaba, Tokyo, Japan, for definite information concerning the disease in that country. It seems from the following reply that the plum wilt is not known in Japan. We take the liberty of quoting Director Matsui's letter:

"Dear Sir: In reply to your letter of March 14, 1910, let me state that the professors of both horticulture and vegetable pathology say that they have not seen the plum wilt described by you.

Yours respectfully,

Signed: N. MATSUI, *Director.*"

#### THE DISEASE INFECTIOUS.

The first work with the malady was an effort to find out whether or not the disease is infectious—that is, could be transferred from a diseased to a healthy tree. At first all inoculation failed, but in the spring and summer of 1910 we succeeded in securing a high per cent of successful inoculations. The first of these successful inoculations was obtained by taking diseased tissue from an infected tree and placing it under the bark of a healthy one. Following this, media cultures were made from the diseased tissue and other inoculations made from these cultures. Repeated inoculations were made from media cultures until the destructive organism was isolated.

It was observed that usually about three days after an inoculation, the cambium layer showed signs of the presence of the disease, but there seem to be no definite lapse of time before the leaves wilted. Some inoculations would wilt the foliage in ten days, while others would require a period of more than twice as long. A small limb would wilt much sooner after an inoculation than a large one. This, doubtless, is due to the greater surface to be covered by the disease on the larger limb. The organism seems to attack mostly the cambium layer, but we have not yet determined whether or not it also attacks the wood to the extent of clogging the pores and stopping the sap flow.

#### THE ORGANISM OF A FUNGUS NOT A BACTERIUM.

Contrary to the hypothesis of Prof. Starnes that the organism is a bacterium, we have found that it is a fungus. However, we have not yet

been able to make the vegetable part of the fungus (*Mycelium*) produce spores, so that we are not able, as yet, to determine the species of the fungus. Mr. Temple has had this fungus growing in media culture since last fall, but no spores have been formed. It is hoped that success will be reached on this point by next spring.

#### HOW THE FUNGUS GAINS ENTRANCE.

Our work and observations have led us to believe that the fungus gains entrance almost entirely thru ruptures of the surface caused by pruning shears, cultivating implements or some similar agency. In fact, almost every infection found could be traced directly to some such break in the outer bark. Indeed we believe that the fungus would hardly be able to enter through unbroken, healthy, living bark.

#### REMEDY.

The remedy, we believe, would be preventive measures rather than curative; for from the nature of the disease spraying would be practically as useless as in the case of pear blight. In fact, so far as our observations go, the precautions taken to control pear blight would apply also to this disease.

Another field for work along this same line, lies in selecting resistant varieties. This, of course, will take time. While almost all Japanese and hybrid plums are susceptible to this disease, yet some are more resistant than others. From such resistant individuals a starting point may be gained.

#### BLOSSOM END ROT OF THE TOMATO.

In August, 1909, at a meeting of the State Horticultural Society, at Athens, I gave in a paper some results of our work at the Georgia Experiment Station to control the blossom-end rot of the tomato. Since that time, I have continued the study of this disease in co-operation with Mr. J. C. Temple, the Bacteriologist of the Station. While our results up to date are not conclusive, still it is not out of place to give a brief report upon the work at this point.

The first subjects for investigation this year were the tests of the different theories held by many practical gardeners and truckers as to the cause of this disease. Some of these theories were disproved, while others are still under consideration.

#### STAKING NO REMEDY.

The widespread belief that the disease spreads from the soil to the fruit and is therefore less severe on vines staked than on those on which the fruit lies on the ground was practically disproved. During the season some vines were staked and some left unstaked, with the fruit left in contact with the soil. The fruit lying on the ground did not seem to be any more subject to the attack of this disease than the fruit a foot or more from the ground. Of course the fruit on the ground was attacked more by other rot than that on the staked vines, but as far as the blossom-end rot was concerned it was practically impartial to the two sets of vines.

The entire experiment showed that staking the vine does little, if any, good in controlling the disease.

#### DRIED COROLLA OF FLOWER HAS NO EFFECT ON THE DISEASE.

The next theory disproved was that the disease was more prevalent among those young fruits which retained the dried corolla of the flower than among those which shed it. Close observations from the beginning of the season showed that the dried flowers hanging on the young fruit had no effect on the occurrence or spread of the disease.

#### KIND OF FERTILIZER USED MAKES NO DIFFERENCE IN DISEASE.

Another impression that is common among truckers and gardeners, is that the fruit of vines fertilized with stable manure is more subject to disease than that of vines fertilized with commercial fertilizer. To test this, five rows were laid off an acre long and four feet apart and divided into four equal plats. Each plat extended across all four rows.

Plat No. 1 received a heavy cart load of stable manure and 101 lbs. nitrate of soda.

Plat No. 2 received 40 lbs. 16 per cent acid phosphata.

Plat No. 3 received 40 lbs. ground ammoniated bone.

Plat No. 4 received 34 lbs. kainit.

The tomato plants were set out March 30th, and were given a distance of four feet apart in the row. The rows were set to five varieties, each variety occupying a row, and extending across all the plats. The five varieties used were as follows:

Row. No. 1—Improved Purple Acme.

Row No. 2—Redfern Beauty.

Row No. 3—Matchless.

Row No. 4—Sparks' Earliana.

Row No. 5—Chalk's Early Jewel.

The plants of all the plats made a satisfactory growth and set a fair crop of fruit. Of course, the plat receiving the stable manure and nitrate of soda made the rankest growth of vine.

The first outbreak of the rot occurred about the 5th of June. This was on the second setting of fruit rather than on the first, as was the case the summer before. The outbreak of the disease was as bad on one plat as on another, regardless of the kind of fertilizer used.

On June 22 the first harvest of fruit was made, and on June 27th, the second harvest was made. At these two harvests, the per cent of diseased fruit was obtained by actual count, rather than by weight. All specimens of fruit both ripe and green having even a speck of the blossom-end rot were placed in one pile. Only ripe, sound fruits were placed in the other pile. The per cent of the rot in the stable manure plat would have been lower had the fruit ripened as early, for in getting the per cent rot, only the sound, ripe fruit was counted against all diseased fruit, both ripe and green.

The following table will show the average per cent, by count, of diseased fruit harvested at the first two pickings:

Plat No.	Fertilizer Used	No. Sound Ripe Fruit	No. Diseased Ripe and Green	Percent of diseased Fruit
1.	Nitrate of Soda & stable manure	197	58	23
2.	Acid Phosphate	102	24	19
3.	Ground Bone	116	40	26
4.	Kainit	44	7	14

It will be noticed from this table that the per cent of diseased fruit on the plat fertilized with stable manure ranks second from the highest. However, this per cent would have been lower if only diseased ripe fruit had been counted against the sound ripe fruit, for the plat fertilized with stable manure made a ranker growth and there was a larger number of green fruit on it in proportion to the ripe fruit to be considered. On the whole, the kind of fertilizer used seemed to make no difference in the disease.

#### SPRAYING HAS NO EFFECT.

Further experiments in spraying simply corroborate our first years' results that spraying did little or no good in controlling this disease. For this work four varieties of tomatoes were selected: New Stone, Golden Queen, Long Keeper and Ponderosa. The plats and the varieties for the tests in spraying were arranged in the same way as were those for the fertilizer experiments before mentioned. The plants were also set to the field March 30th. The different plants were sprayed with different formulæ, as follows:

##### Plat No. 1:

Copper Sulphate (blue stone)..... 4 lbs.  
 Stone Lime..... 4 lbs.  
 Water .....50 gal.  
 Arsenate of Lead ..... 2 lbs.

##### Plat No. 2:

Bogart's Concentrated Lime Sulphur Compound.....2 1-2 gal.  
 Water .....50 gal.

##### Plat No. 3.—Left Unsprayed.

##### Plat No. 4:

Concentrated Lime Sulphur Wash (home made).....2 1-2 gal.  
 Stone Lime .....5 lbs.  
 Arsenate of Lead .....2 lbs.  
 Water .....50 gal.

##### Plat No. 5:

Copper Sulphate (blue stone) .....5 lbs.  
 Rosin ... .....5 lbs.  
 Potash (lye) .....2 1-2 lbs.  
 Stone Lime .....7 lbs.  
 Concentrated Lime Sulphur mixture (home made).....1 1-2 gals.  
 Water .....60 gal.

All plats were thoroughly sprayed the same day each time. A total of six sprayings was given on the following dates: May 3, (the time when

the plants begin to bloom), May 13, May 24, June 2, June 11, June 23. Six applications of a spray solution would under average conditions be considered unprofitable for a tomato crop, but in this our object was primarily to ascertain whether or not spraying would have any effect in controlling the disease.

On the 5th and 6th of June, the blossom-end rot occurred on all the plats—on those sprayed as well as on the unsprayed plats.

The following table will show the number of diseased fruit by actual count. The count was made two days after the outbreak of the disease, and before any of the fruit had ripened:

Plat No.	Spray Solution Used	No. diseased fruit
1.	Bordeaux and Arsenate of Lead .....	12
2.	Commercial Lime-Sulphur Wash.....	19
3.	Unsprayed .....	57
4.	Home-made lime-sulphur mixture & arsenate of lead...	62
5.	Bordeaux—Lime-Sulphur .....	55

The following table gives the per cent of the diseased fruit from first two harvests after the fruit had begun to ripen. The first was made June 27th:

Plat No.	Spray used	No. ripe fruit	No. diseased fruit green and ripe	Per cent diseased fruit
1.	Bordeaux and arsenate of lead	6	31	84
2.	Commercial Lime Sulphur mixture	7	39	85
3.	Unsprayed	20	92	82
4.	Home-made lime sulphur and arsenate of lead	15	60	80
5.	Bordeaux Lime-Sulphur mixture	5	66	93

It will be noticed that the diseased fruit in this last table is very high. This was due to the fact that all the green, as well as the ripe diseased fruit, was pulled and counted, while only the ripe of the sound fruit was counted. It will also be noticed that the blank plat stood second from the bottom in percentage of diseased fruit. This goes to show that spraying for the blossom-end rot is practically useless.

After this one outbreak of rot, the disease ceased on all plats and the plants matured a fair crop of fruit.

Still another widespread opinion regarding this disease is that the insects are responsible for its spread. It is thought that the insect makes infection either by puncturing the young fruit and introducing the organism or by infecting the fruit through the flower. Some experiments were planned also to ascertain as far as possible, in one season, the facts in this contention. However, no direct proofs that insects transmit the disease.

About two dozen vines were planted a half mile from any other tomato patch or garden, and on soil that had grown no tomatoes for more than 25 years, if ever. It was thought that by isolating these vines from other to-

mato plants, the visits of the insects thought to be transmitters of the disease would be less likely to occur. However, when these isolated plants came into fruitage, it was noticed that the blossom-end rot occurred on these very much in the same way and at the same time that it occurred on the regular experimental plants.

Further tests of this contention were made by placing mosquito nets over 20 plants to debar, completely, the visits of the insects. These nets were placed over the plants shortly after they were set to the field. It was noticed that during the spring and early summer the plants under the net were of a darker or deeper green color, and made more rapid growth than did the plants on the outside. Only one diseased fruit was found on the plants grown under the nets, and this was a fruit that rested against the net and could have been punctured easily by insects from the outside.

It cannot be said from this, though, that the absence of the disease was due to the absence of the insects, for it was observed that the temperature and moisture surrounding the covered plants were different from that surrounding the other plants. This change in temperature and in moisture changes the environment of the plant and likewise of the disease.

#### SOIL AND ATMOSPHERIC MOISTURE AS FACTORS IN THE CONTROL OF THE BLOSSOM-ROT DISEASE.

Prof. G. E. Stone, of the Massachusetts Agricultural Experiment Station, has done a great deal of work on the blossom-end rot of tomatoes under green house conditions. It seems that in Massachusetts and some other sections of the North and East, the blossom-end rot is quite severe in tomato forcing houses. However, we have experienced very little trouble with the disease in the forcing house at the Georgia Experiment Station. In fact, we have found it difficult to get a large per cent of the inoculation to take, that is, we found it a difficult matter to infect sound fruit, either from the diseased specimens or from media cultures.

In making a report upon the work done on the blossom-end rot in the green-house, Prof. Stone has the following to say:

"The blossom-end rot of tomatoes is very often a very troublesome disease, and furnishes a good illustration of a trouble brought about by neglect of certain details necessary for the normal development of the crop. This disease is caused by bacteria, one or more fungus growths occasionally accompanying the bacteria, lack of water in the soil when the fruit is maturing, especially if the atmosphere of the house is more or less dry, will cause the rot, and a liberal supply of moisture, preferably supplied by irrigation, will prevent it. Moisture plays an important role here because a too dry atmosphere causes the fruit to crack at the blossom-end and become more perfectly developed, and infection follows. This rot is more common near steam pipes, where the air is drier, and in the spring, when the sunlight is more intense and prolonged, than during the late fall or winter. In the spring transpiration is more active, hence the necessity for more soil moisture and more attention to wetting down the house. Sunshine and transpiration are important factors in causing the rot, and

our experiments have shown that slight shading in the spring months is of great value in holding back the trouble. In our experiments in the green house we obtained over 30 per cent more blossom-end rot plants which were watered on the surface, than those sub-irrigated, and a very material decrease in the amount of rot occurred from the shading afforded by the plants."

These results compare favorably with some results we have secured from our field work at the Georgia Experiment Station. We observed that we had an outbreak of the disease only in dry weather, and as soon as the rains came, the rot stopped.

#### A COMPARISON OF THE DATES OF RAIN AND THE APPEARANCE OF THE DISEASE.

From the 24th of May until the 5th of June we had practically no rain and at the same time we had, as a rule, a dry stiff wind. On June 5th we had a .24 of an inch of rain, and on June 6th, .30 of an inch of rain. On June 10th we had 1.05 inches of rain. This was followed by light showers for several days. The first appearance of the disease was on the 5th and 6th of June, and the most disease appeared almost exclusively on the fruit which "set" or shed its blossoms on the 24th and 25th of May. Fruit set earlier than this was practically free of the disease. Thus it seems that the age of the fruit is a factor in the development of the disease, as well as the weather conditions. I think we are safe in saying that the disease appeared before the rains came, for the disease in its earliest stage is so inconspicuous that it would hardly be detected with the unaided eye. We do know, however, that as soon as the soil was well wet, which occurred June 10th, we had no more blossom-end rot of the tomato.

#### CONCLUSIONS.

Our work so far has led us to believe that staking the plants, the kind of fertilizers used, the adherence of the dried corolla to the young fruit, spraying the plants with fungicides and insecticides, or the attack of insects have little or no effect on the occurrence, the spread, or the control of the disease. We do believe, however, that the age of the fruit, and the soil and atmospheric moisture have a marked effect upon the occurrence and severity of the disease. As yet we have no practical remedy to offer for its control.

However, our plans are to carry on the work for one or two seasons more and try methods of irrigation and shading, as well as the selection of resistant varieties. In the meantime we hope that any of our friends who observe new points on the behavior of this disease will give us the benefit of their experience.

CHAIRMAN HUNT: It is necessary for us to go right along, if we get through, and we will now hear from Mr. J. B. Wight of Cairo, Ga., on the "Present Status of the Pecan Industry."

## PECANS IN GEORGIA.

J. B. WIGHT, Cairo, Ga.

Pecans are at home in Georgia. Originally introduced into the State, they have found a congenial soil and climate, and are making records as to growth of tree and bearing qualities that compare favorably with the best from any section. Scattered here and there over the State are individual trees that are from forty to sixty years of age. The orchards are of more recent date. There are a few of these that are more than twelve years of age, and they are of limited area. The immense expansion of the pecan industry of the State, which has been especially marked during the last three or four years, is due to the behavior of these older trees. It is not surprising that where single trees were bearing from two hundred to five hundred pounds of nuts per year, that people should begin to think about setting orchards on the assumption that what one tree does, may, under similar conditions, be duplicated by a hundred, a thousand, or even ten thousand trees. As showing what individual trees have done, it may be interesting to have the record of two or three trees as a basis for what may be expected from the larger plantings.

Probably the oldest tree of which an accurate record has been kept, both as to growth and bearing, stands at my home in Cairo. This tree is a budded Frotzcher, set January, 1892. The following is the record to date:

Circumference	Nuts in pounds
1894.....8 1-2 inches.	.....
1895.....12 1-4 inches	.....
1896.....14 1-2 inches	.....1 nut
1897.....20 inches	.....7 lbs
1898.....25 inches	.....10 1-2 lbs.
1899.....29 1-4 inches	.....13 1-2 lbs.
1900.....33 1-4 inches	.....27 lbs.
1901.....37 1-4 inches	.....16 lbs.
1902.....40 1-4 inches	.....45 lbs.
1903.....44 inches	.....80 lbs.
1904.....46 3-4 inches	.....121 lbs.
1905.....50 inches	.....131 lbs.
1906.....53 inches	.....96 lbs.
1907.....56 inches	.....30 lbs.
1908.....59 1-2 inches	.....169 lbs.
1909.....62 inches	.....352 lbs.
1910.....65 inches	.....196 lbs.

Do not understand me to say that this record will be duplicated in large orchards. While it is possible to do this, yet it is not likely that it will be done, from the fact that a large orchard is not likely to be cared for so well as has this individual tree. Standing on the edge of my garden as it does, it has been well fed; and in turn has helped very materially to feed the people who have cared for it. Most of the nuts from this tree have been sold at fifty cents per pound. It will be readily seen, therefore,

that it has netted for the last three years an average of at least \$100 per season. As a further illustration of what has been done: There are about two acres of land in my town lot, which is partially bordered by pecan trees, which are younger than the above tree, some of them having just come into bearing. In all there are twenty-two trees, twenty of which in 1909 bore more or less nuts. The net sales from these trees that year amounted to \$400. Last year there was a short crop and the yield was valued at something like \$250. This is a fair illustration of what can be done on a small scale; and yet, when these trees come into full bearing they will easily average from one hundred to three hundred pounds of nuts per tree annually. In addition to the revenue, the beauty of the shade that comes from these trees will add very materially to the value of the property.

Living on an adjoining lot to me is Mr. K. Powell, who has a seedling tree growing in his back yard. This tree is from a nut planted in 1887. For a seedling this is an exception, both in the regularity and quantity of its product. For the last three years it has borne an average of over four hundred pounds of nuts per year. The surplus above what the family used for domestic purposes, was sold for twenty-five cents a pound.

At Monticello, Fla., on the home lot of Mr.—Lindsey, there stands a seedling tree which at twenty-one years of age bore 638 pounds of nuts. This is only a medium sized nut, worth probably twelve to fifteen cents per pound. I mention the above instances, not that they are exceptional, for these yields have been surpassed, but to call attention to the possibilities of pecan production. When we are told of apple, orange and grapefruit trees that yield from twenty-five to fifty dollars' worth of fruit in one season, we do not think the record wonderful, because it comes from the far-off States where lands are fertile and climate is genial. I want to emphasize the fact that we have in Georgia, lands that are just as productive, and on which the sun shines just as brightly as on any country in the world. When it is further considered that the pecan tree is immensely larger than the apple or orange tree, and that its product pound for pound is more valuable, we need not wonder at what has been done. It may be true that the prices obtained for fancy pecans are higher than they will be when more nuts are grown. I started to growing pecans after a very careful consideration of the situation, and the conclusion then reached was that they can be profitably produced at ten cents per pound; and there has been no occasion to revise this opinion. But it can be safely said that the better grades of pecans will never sell for ten cents per pound, unless there is an entire readjustment of values on other commodities. When there are sufficient nuts to justify it, pecans will be as staple a product as cotton, or corn, or beefsteak.

The best posted authority in Georgia on pecans estimates that there have been fully ten thousand acres of pecans set in Georgia during the season just closing. Several orchards of a thousand acres each are included in this. It can safely be stated that there are now thirty thousand acres in pecan orchards in the State of Georgia, and this will be increased from year to year as the decades roll by. Texas, with her thousands upon thousands of nature-planted groves, now holds the distinction of

being the leading pecan producing State in the Union. But in pecandom at least, "eastward the star of empire takes its flight." And while Texas is setting many orchards, yet it requires no juggling with figures to show that when the next king of the pecan world is crowned, that it will be on Georgia's fair brow that the diadem will rest.

At one time it was thought that pecans could be grown successfully on alluvial soils. This was a natural inference from the fact that most of our native pecan groves are on the alluvial lands. But the highlands have been tried, and have not been found wanting. There are no better pecan lands anywhere than the best grade of Georgia, Florida and Alabama loams, which are underlain by a clay subsoil. The experimental stage in the pecan industry has passed. Not that everything has been learned, but sufficient is known about growing them to assure the permanency of the industry. That dangerous stage in every industry when it is represented that there are no enemies, and that all that remains is to set trees and grow rich, has gone. Pecans have their enemies, both insect and fungus; but their batteries have been located, and some of their guns have already been spiked. Prof. L. H. Bailey once declared before the Georgia State Horticultural Society that he would not go into an industry that had no enemies, because it would soon be overrun by those who want to have an easy time. Pecans have enough enemies to satisfy the querulous, and yet they are not unconquerable. In fact, they are not so numerous nor formidable as those which confront the growers of peaches, apples, plums and the like.

Pecan trees are long lived. And as is usually the case with such, they do not come into full fruitage as soon as do many shorter lived trees. Pecans have been cut in Texas, the rings on which showed that they were fully four hundred years old..

It is a well known fact that they do not reach their prime until they are from fifty to one hundred years of age; and yet the best varieties of pecans are not slow in bearing. Under the most favorable conditions, they generally begin to yield nuts at from four to six years of age. But it is unreasonable to expect profitable crops from them before they are eight or ten years old. Some extravagant claims have been made, and some unreasonable expectations have been excited on this subject. There are those who think they will be profitable crops of nuts when they are five or six years old; and while it may be possible to do this, under the most intensive cultivation, yet for the most part those who have these expectations are doomed to disappointment. When twelve to fifteen years of age, a pecan orchard should, under favorable conditions, yield a net income of \$100 per acre. This is a conservative statement, and has been frequently surpassed even by seedling trees; but if a grove will yield an annual net income above all expenses, of \$100 per acre, it is doing well enough. This means that an average family with ten to twenty-five acres of pecans, has a good living; and one with fifty acres is on the road to wealth.

There are three conditions that are necessary to success in pecan growing:

(1). Only strong, vigorous trees should be set. There is a very great difference in the natural vigor of pecan trees. Rants in the nursery, even under the most favorable conditions, will never prove vigorous in the orchard. On the other hand, the tree that has started off well in the nursery, if properly cared for, will continue to do so when transplanted in the orchard.

(2). Pecan trees should be set only on the best land, not that they will not succeed on medium grades of soil, but because a tree that has the intrinsic value that these have, deserves the best. One hundred trees, well cared for, on good land, are more desirable than five hundred which are neglected.

(3). It is a mistake to think that pecan trees can be set, and then left to hustle for themselves. During the first few years they need careful cultivation and regular fertilization. Nothing should be allowed to grow within a radius of a few feet of the tree until it is well established. Even then, trees should be cultivated and fertilized. There is no better crop to grow among pecan trees than cow peas, or some other leguminous crop, which should be highly fertilized, and the stubble turned under when the crop is mature. Five hundred pounds per acre of a high grade fertilizer would be considered liberal fertilizing by some. But on trees that are twelve to twenty years of age and in full bearing, I believe that even a ton of high grade fertilizer per acre will yield a large income on the investment. Trees highly fertilized will not only produce more nuts, and do so more regularly, but the nuts will be larger. As an example of this: I have a neighbor who has a seedling pecan tree standing apart in a large field. The tree is fourteen years of age, with a diameter of fifteen inches. These nuts are rather small, the market price being about twelve cents per pound. To test the effectiveness of fertilizer, he applied about fifty pounds of guano, worth seventy cents, broadcast around the tree. The result was that the succeeding crop of nuts was at least one-third larger than previously, and the market value was relatively increased, so that there was double advantage.

Even if there were no more nuts, the size being one-third larger, made a fifty per cent increase in the number of pounds, and instead of selling at twelve cents as before, they sold at twenty cents. In fertilizing the pecan a mistake is sometimes made in putting the guano too near the tree. It should be put well out from the tree where the feeding roots are at work. In fact, the best way to fertilize a bearing orchard is to enrich the whole of the land, then plant some crop that will improve the soil, and the trees will get their share.

The cultivation of the pecan is not difficult. Apply plenty of fertilizer, cultivate as thoroughly as you would a peach or an apple orchard, and results will be achieved.

The enemies of the pecan were alluded to above. They are not hard to find, nor difficult to control, when one knows when and where to look for them. It is unwise, however, for a person to go into pecan growing unless

he has some knowledge of these enemies. And the same thing is true of every other product of the soil. The day when loose methods and ignorance were substantially rewarded, has about passed, and we will not greatly mourn its leave taking. The successful business man knows his work, and has his hands on the reins. The successful fruit grower must do the same.

With some knowledge of the problems that confront the fruit growers in other lines, let me say that I do not believe there is a more promising field in American horticulture than pecan growing for sections that are adapted to this nut. Many of the difficulties that are in the way of the orchardist in other lines do not trouble the pecan grower. If he is not ready to gather the nuts in October when they are ripe, he may wait until November; and barring the fact that his neighbors may make the work of harvesting less onerous, the nuts will be just as good then as if they had been gathered earlier. If the market is not favorable at harvest time, he may store them away for six months or longer, and they will be as sweet then as ever.

The bug-bear of over-production has been haunting some, who are afraid that more nuts will be produced than can profitably be marketed. With a product as palatable and nutritious as pecans, this generation nor the next will ever see a glut in the pecan market. As nuts become more plentiful, and consequently cheaper in price, there will not only be more consumers, but those who are already eating them will use more. Furthermore, they will be introduced into the markets of the world, and hundreds of millions of people will be consuming them, where there are now only millions. Our physicians and scientists are telling us that if more nuts and fruits were eaten and less meats, that we would be healthier, and if healthier, then happier. Pecans are getting to be more and more a staple product. Future generations may see over-production; but when that far distant time is reached, wheat will be a glut in the market, and porter-house steak will go begging for a buyer.

I cannot close this paper without urging that every person in the pecan belt, which is practically commensurate with the cotton growing region, should grow at least a few pecan trees. The unfortunate dwellers in the most crowded parts of our cities may not have room. But there are few homes even in our cities and large towns where there is not enough space to accommodate one or more trees. One tree, well established, will furnish nuts sufficient to last the average family for a year. And a farmer, though he may have only a few acres of land, is neglecting a most profitable money crop when he fails to set out a few pecan trees around his garden or yard. These trees will furnish a shade in summer, nuts in winter, and will add beauty and stateliness and comfort all the time. There are few New England homes that have not their apple and other fruit trees; and the day is not far distant when the same can be said of pecan trees growing about the homes in our Southland.

As shade trees they are beautiful; and there are none that yield more in pleasure and profit than do pecans.

Twenty-three years ago I read this advice from a veteran pecan grower,

who still abides with us: "Young man, set a pecan grove, and when you are old, it will support you." I believed then that the advice was sound; I now know that it is so. And so I pass the word along: Young man, plant a pecan grove. It will help to make your days happier and your pockets heavier. It will lighten your burdens while here, and when you are gone your children will rise up and call you blessed.

MR. LOMBARD: Mr. President, the Finance Committee would like to make its report.

CHAIRMAN HUNT: All right, sir, we will hear from you now.

MR. LOMBARD: We, your Committee, have examined the Treasurer's books, and vouchers, and find that the vouchers accord with the entries upon this book, and that the true balance on hand December 31, 1910, is \$161.25.

Motion was made and carried that the report of the Committee be accepted and spread upon the Minutes.

CHAIRMAN HUNT: If you were going to plant only one variety of pecan, Mr. Wight, and you didn't care a thing for the market, just wanted a good fruit, what nut would you plant?

MR. WIGHT: The Schley.

CHAIRMAN HUNT: I thought so.

MR. WIGHT: That is, if I didn't care a thing about the Northern market. The Frotscher, I believe, will make the most money. If I wanted a pecan simply for home use I would plant the Schley; if I wanted to market them, the Frotscher.

QUESTION: Would you keep your pecans cut back the first and second years to force roots, or not cut them back at all but prune later?

MR. WIGHT: My practice is to get the tree up as soon as possible to five or six feet high, where it ought to branch out, then give it the freedom of the world, and it will take its share. I want the limbs high enough so

that the ground can be kept cultivated underneath. It needs comparatively little cultivating. Some varieties rather run upward, and some spread out, but my practice is to bring it up to where it should spread out, then turn it loose and prune just as little as possible.

COL. FORT: It has been insisted that you cannot take an ordinary seedling pecan tree and increase the size of the nuts by fertilization and cultivation. I would like to hear from Mr. Wight on that question.

MR. WIGHT: The experiment mentioned in my paper is not necessarily conclusive, but it was carried out by Col. Chas. A. Van Duzee at a pecan grove twelve miles from here. He got these results exactly as I gave them—he got 50 per cent larger nuts, and increased more than 50 per cent a year. My experience with pecans is that, if you will take good care of them and feed them well, you will grow more nuts and you will get larger nuts.

COL. FORT: The nuts in my orchard are not very large. I think the orchard is probably twenty years of age. I have never thought it paid to cultivate them at all, but if I thought they could be increased in size and yield by cultivation, I would take that up. The larger growers near DeWitt insist that you can't increase the nuts by cultivation, and I therefore, brought that question up.

MR. WIGHT: I think, if you will reason by analogy, and look into experiments along this line, you will find it to be true.

MR. STUCKEY: Have you experienced much trouble with this little beetle that bores into the nut, down there?

MR. WIGHT: The husk-borer? Yes sir.

MR. STUCKEY: About what per cent do you lose?

MR. WIGHT: The husk-borer does not seem to diminish the quantity of the crop. The main trouble is that he disfigures the nut, makes some of the hull adhere to the nut, and makes it a little unsightly.

MR. STUCKEY: The experience there at the Experiment Station is that about 40 per cent. are destroyed. They bore right on inside of the nut into the meat.

MR. WIGHT: That's not the husk-borer. We don't have that.

MR. STUCKEY: If that should become very numerous, I believe it would cause trouble. They had it in Texas. I got 200 lbs. of nuts for planting, and I noticed in a lot of them there was a little round hole about the size of a lead pencil, where the worm had bored out. Do you top-work your trees?

MR. WIGHT: No, sir.

MR. STUCKEY: If your yield is not satisfactory, it would be better to do that. A gentleman told me that he had a tree three feet in diameter, and it bore about five pounds of nuts. It ought to bear nearer 500 than five. So it is best, under those circumstances to top it. If your tree does not bear well after it gets 8 to 10 inches in diameter, you can easily top it; cut that sorry head off and put a better one on it.

QUESTION: What is better—12 trees to the acre or more?

MR. WIGHT: If your land is good, 12 trees to the acre is best. If you put them much closer together than that, our grand-children will find that those trees are getting so thick that they will get in each others way.

MR. STONE: In regard to increasing the size of nuts by the application of fertilizers, I will state that there is

one nut that it is not necessary to apply any fertilizer to, to increase. That is an artificial nutmeg made by machinery. (Laughter.)

MR. WIGHT: A cent to a cent and a half a pound ought to cover the cost of gathering. My method is to get you a large sheet, and shake them off and gather them up.

CHAIRMAN HUNT: Prof. McHatton is next in order. We will be very glad to hear from Prof. McHatton on the subject "Horticultural Education at the State College of Agriculture."

#### HORTICULTURE AT THE STATE COLLEGE OF AGRICULTURE.

T. H. MCHATTON, State College of Agriculture, Athens, Ga.

In 1908, when the re-organization of the State College of Agriculture took place, the Department of Horticulture was one of the minor ones in the institution, offering only a very elementary course in the subject, and giving no chance for specialization or further study in the field pertaining to pomology, olericulture, and other horticultural subjects. At the time of the occupancy of the new college building in January, 1909, the equipment of the Department consisted principally of a pair of pruning shears and one saw. All the orchard and fruit trees had gone when the old University was sold, and before the present organization was perfected, the orchard in the new University extension proper had been removed to make room for experimental plats.

From the beginning of the College to the year 1908, horticulture had been in charge of an instructor, but in that year of re-organization it was decided to place this Department on a par with the others with a full professor at its head. Imagine the feelings of one who was enthusiastic in his work when it was thoroughly realized that everything had to be built from the bottom, and that before a really good course could be given in horticultural subjects a Department had to be built. This was a strange thing indeed in a State which has the horticultural possibilities of Georgia, and which has for a number of years stood in the limelight as one of the peach producing centers of the country.

Nothing could be gained by standing around and talking. It was necessary to hustle if the institution was to take its place in the State, as it should, and really the development in the past two years has been marvelous. Old red clay hills have been turned into orchards; gullied fields have become vineyards; small fruit plantations have taken the places of blackberry thickets and old hedge rows; where the implements were sheltered by the sky now are found sheds, barns and spray houses with laboratories, furnishing ample room for the storage of all horticultural imple-

ments, as well as places for instructing the young men who are taking courses in the Department. Something near forty acres has been reclaimed and put into horticultural crops.

This season, provided the frosts do not stop it, there will be a crop of peaches, small, it is true, but a beginning, and in a few years the apples will be bearing. The vineyards will produce this summer, as well as the small fruit plantation. Within a few years more sections of the departmental farm will be in condition for experimentation with truck and vegetables.

The aim now is to so treat this land with legumes and general farm crops as to bring it up into condition of tilth fitted for the production of truck crops. For the past two years the work has been mainly constructive, not only in the building up and the construction of the Department, itself, which acts as a laboratory both for practical instruction and scientific investigation; but also the courses of instruction had to be mapped out and worked into shape so that those desiring information and instruction along horticultural lines could obtain the same, and going hand in hand, in this way the equipment of both the students' and private laboratories, as well as the furnishing of the shelves in the library with books necessary to the good fruit grower or vegetable gardener. Where there was nothing before in the way of equipment to facilitate in the way of instruction, today the College is only too proud to show any one the departmental laboratories in which can be found all the necessary apparatus for handling a section of twenty men in any branches of horticultural work.

Besides, the private laboratory is also now in a condition to be used for research work along practically all lines in which the horticulturist should be interested. Where before the most elementary lines of work were offered, today there is found in the catalogue of the University of Georgia twelve courses offered in the Department of Horticulture. Three of these are compulsory in the Freshman year, and their aim is to place the Georgia boy who graduates from the State College of Agriculture, no matter in what branch, in a position that he will be able to produce and enjoy the many kinds of fruit and vegetables that are so well adapted to his home State.

Possibly the main object of this course is to show the young man that success in fruit growing can be obtained only through "stick-to-itiveness" and a proper knowledge of the plants with which he is dealing, as well as methods by which they may be protected and improved. It is hoped that every young man who takes this course will know enough not to plant out an orchard and turn it over to Providence. He should know when finishing this course that such a method of growing fruit is not a paying proposition. After this year's work courses beginning in more or less the specialized line of horticulture are offered as electives in the Junior year. A study of small fruits, the harvesting, marketing, and storing of fruits, as well as the history and description of fruits, green-house management, floriculture, construction of green-houses, the study of orchards, gardens, diseases and pests, as well as the method of controlling the same, are found in the Junior year. The Senior year offers a course in landscape garden-

ing. It is mainly for the owner of a country home or a small city home. Later on in this year a study is given in the literature of horticulture, and a man who is about to graduate in horticulture as his major is allowed to specialize in some special line and runs in connection with it some experiments. In this way it is possible to give any young man of this State a fairly good knowledge of horticulture and graduate him as from the other institutions in this country; that is, putting him into a position to go out into the world and make his living out of the growing fruits or vegetables or some of the allied branches of horticulture.

As mentioned above, up to the present time the main work has been construction, and now besides the head of the Department, there is attached to it an Extension Horticulturist, who is carrying the work out into the State and among the people for whom it is ultimately designed to serve. Such conditions make it possible for those remaining at home to take up some line of scientific investigation. Exactly what this line will be has not yet been given out. There will be undoubtedly something of a scientific interest to the horticulturist who loves his business as a science, as well as other experiments along very practical lines to be disseminated throughout the State for the benefit of fruit growers and orchardists.

It was indeed a pleasure to be asked to give a sketch of the horticultural work at the State College, at this meeting, because the Department feels that unless it gets in touch with the people of the State, and through them comes in contact with the young men who are growing up, it is more or less a failure. The object of the College is the instruction of the youth of Georgia, and the main object of the Department of Horticulture at the present time is to better the fruit conditions of the State, and to put the people of Georgia in a position to be able to turn to horticulture for a livelihood when they are harassed by such troubles and pests as the cattle tick and boll weevil. To do this, it must be assisted by the men of the State Horticultural Society, for without their aid it is almost impossible for this Department to develop to this extent.

There are, of course, many things necessary for the future development, but as there are other Departments developing also, it is impossible that all the money necessary can be put into any one of them. Before the development of the courses in horticulture for the Georgia boys, a green house will have to be built, as well as enlargements in laboratory equipment and grounds equipment be made. These things, however, will only come when the Legislature of our State does its full duty by the College of Agriculture. I am not here begging, but as you have put me on the program for this subject, and I feel that you must be more or less interested in the conditions of the Department, as well as the College as a whole, I feel at liberty to say that whenever you find a good chance to do so, you should consider it the part of a citizen of Georgia, and especially a horticulturist, to pull for appropriations for the institution, whose aim is the betterment of Georgia's agricultural conditions in all lines, and the education of the youth of this State.

I have not covered this subject as thoroughly as I might, and I gave you a very short paper, because I thought it would be late on the program, but

if any body here wishes to ask any questions relative to the work of the Department, I will be very glad to answer them.

One other thing. The College library files of Georgia Horticultural Society are not complete. There are a few missing numbers. I had a list on my desk to read to the Society, but I came off hurriedly and forgot it. I wanted to request, if any of you have extra copies of the reports, that you will please be good enough to let me know. I am very anxious to complete my library files, and I will be glad to notify any body just exactly what the numbers are that are missing, if they will let me know that they have extra copies.

**MR. BERCKMANS:** I think you are short the proceeding of 1882, and at the present time there are only two copies in existence, one in my father's library, and one on file with Department in Atlanta. We have a number of copies of different year's proceedings, that father left, and if there are any members who would like to complete their files, not merely out of curosimy, but to complete their files and bind them, we will be glad to furnish them as far as possible. Of some we have probably only a half dozen copies left, and they were published by the Society alone in those days at enormous expense, and it has always been father's idea to try to preserve them as much as possible.

**COL. WADE** of Cornelia then took the chair and stated: "We will now have the pleasure of listening to an address that we have been looking for by Col. B. W. Hunt.

#### BEAUTIFYING RURAL HOME SURROUNDINGS AND CIVIC IMPROVEMENT.

**B. W. HUNT,** Eatonton, Ga.

Beautifying Rural Surroundings and Civic Improvement was assigned to me as a theme by the late Dr. Berckmans. How he preferred the subjects treated I do not know, and it is endless.

The word rural as used in the text, I take it, refers to country as well as suburban and village homes, with sufficient space for ornamental grounds to be made the dominant feature in connection with the residence proper. And civic improvement, I understand, includes the making of attractive streets, parks, sidewalks, and the beautifying of private grounds exposed to public view. The treatment of streets in cities and villages is necessarily one of formal gardening in contra-distinction to landscape gardening. The latter term being restricted to the creation of rural pictures by

the landscape architect, views pleasing to the art sense of the observer. The successful landscapist creates a rural scene that obscures all the artificialities of his labor, following apparently the lines of nature's own work from a totally different standpoint, toward a result as formal as the exigencies of the case may require.

To be specific, if the civic improver be engaged in planting shade trees on a straight street, he must keep them in perfect alignment, and all should be of the same variety, all of similar size and height. Otherwise the formal straight line will prove a more or less disappointing failure. On the contrary, the beauty of the landscape gardener's planting is enhanced by the different varieties of the trees he may plant, by their varying sizes, colors, shapes, and manner of growth. The artistic grouping of trees and shrubs, allowing large open spaces carpeted with grass, makes a beautiful picture of his design. To realize where the formal treatment is necessary, where the natural grouping is most pleasing to the art loving observer, where the one may best blend into the other manner of treatment, constitutes the successful landscape architect, the true creator of ornamental gardening.

There must be some formal treatment in all home grounds, I take for granted, because the dwelling itself is the most formal of objects, and he of the informal school must tame Nature's wild mood at, or near, the residence. Otherwise we would be as savages dwelling in the jungle. How to blend the natural with the formal and artificial, successfully, appears to me to be the key to the treatment. Here is where the endless improvement of grounds enters into the home life of the occupants. The very entrance to a home from a street is obliged to be formal and straight. The walks near the house made dry and kept free from grass and weeds, all tell of formal treatment—the taming of nature's moods. Here, then, near the dwelling may be placed the sun dial, the large vases for the blooming tender plants, the true architectural features of use, or apparent use, in the grounds, placed only where formal treatment is in good usage.

The most attractive architectural embellishments about home grounds may be quite inexpensive. Some waste irons and wire for a skeleton, portland cement for the shaping, with a mason's trowel and a varnish brush for tools, directed by artistic hands, will create vases, sun dials, and accessories and all at the most trifling cost. Vases four or five feet high that would cost \$25 to \$50 each may be created at home, costing from 25c to 50c each, with all the enjoyment of creation, thrown in for good measure.

There is planting to be done for present and immediate effect, planting for the future, planting for color winter and summer, planting for all blooming seasons. Planting of trees and shrubs that are of themselves ornamental and willing to grow out of grass borders, planting for roses and crinums and similar plants that to reach perfection of bloom demand raw earth and clean culture, impatient of verdure, of grass, and such should be relegated to a convenient place out of sight, when one is viewing the ornamentals.

My conception of beautifying rural home surroundings does not mean

excessive expenditure of money on the part of the city or town. To be specific, my home town was paying one dollar a tree for uncertain, irregular and bad planting. The Ladies' Improvement Society of which my wife is president, took up the work and planted in one winter 1300 street trees at a cost of 13c a tree, losing only about 5 per cent of the whole plant. No other improvement at so slight a cost could have added so much to the beauty of the small city, and the benefits increase year by year, as the trees grow larger. Ladies are the best of economists in such work, and they are the most willing civic improvers. In connection with tree planting, both for street improvement and for shade in home grounds, in our semi-tropical, sunburned section, please bear with me while I state what I believe is true about sunshine, which is not the orthodox view.

The white race is absolutely dependent on shade for life in the tropics. Sunshine is as deadly there as the cobra's bite, but slower in effect. I fully believe that mental and physical health cannot be enjoyed in Middle and Southern Georgia, except by protection of shade from the sun's rays. The effect of the X-Ray and Roentgen rays on the human body afford an explanation why this is true. We will not argue or try to explain why shade is necessary to the white race, further than to say a white-skinned race has never been found indigenous South of the fiftieth degree of latitude, and we dwell near the thirty-third. The survival of the fittest makes no exceptions. If we remain here as a white race and would save our skin from the pigmentation of the Hindustan races, shade is our only savior. Beauty may be a sufficient reason to the art lover for tree planting, but the economic law of the preservation of the flower of the human race must appeal to all people with overwhelming force. Without shade our race is doomed to a change in color of skin or extermination in this latitude.

To endeavor to do good planning and planting without familiarity with the work of the best artists, would be as impossible as to write good English before learning to spell. He who would lay out and beautify his own grounds, must at least have a working knowledge of landscape gardening. It is well for us to know the work of those who have laid out the grounds that we most admire.

Perhaps some of those present may not remember that Andrew J. Downing, whose work made an epoch in American rural planting, said that Andre Parmentier, the Belgian emigrant of 1824, by "his labor and example effected, directly, far more landscape gardening in America than those of any other individual whatever." It is well for us to realize the debt we owe to little Belgium, who gave us both Parmentier and Berckmans, the latter doing more for Southern horticulture than any other man who has yet lived. There is a reason underlying Belgian influence, I fully believe, but to name it would be too much of a digression at this time. Downing's landscape gardening published in 1841, changed for all time my point of view of this art, as it doubtless has others. Downing's was the first American published book on the subject. Since Downing's death, possibly the calling of landscape gardening has been most advanced in America by the work of Calvert Vaux and Frederick Law Olmstead. I only know from reading, and not from personal observation, the landscape

creations of the more recent artists, Samuel Parsons, Jr., and the original treatment of grounds by Warren H. Manning, and the work of our contemporaries, generally. The Wade grounds here in Thomasville I have read criticisms of, and I understand they are original in treatment and most successful in actual results.

I do not intend to wander far from my theme, but the temptation is irresistible—especially to one who sees and feels the difference between each landscape gardener's work. That is, a close student of this subject may tell where one man's work has ended, and a landscapist of a different school commenced. A musician will recognize Wagner's music, even if he does not know the score, likewise the student sees and feels the master's hand and touch in this creative work.

And what is it all worth? How shall we, who love the beautiful creations of the landscape gardeners, answer the parsimonious economist, who would rob life of all beauty just to increase a hoard of gold? He may have feelings, but he does not feel what we feel—he has eyes, but he does not see what we see; he has capacities undeveloped, perhaps, but he does not enjoy what we enjoy.

To us the garden, the landscape, the trees and shrubs, all justify themselves. The garden ministers in some way to our yearning for the companionship of the beautiful and true.

Is it not better to see, to feel, to enjoy, than to analyze?

PROF. CRAIG: I would like to take this opportunity of calling the attention of the members of the Society to the meeting of the American Pomological Society at Tampa on Thursday, Friday, and Saturday. I am sorry that I have not a program, showing the bill of fare. I assure you, however, that there has been prepared a very attractive program, covering a wide range of subjects of present day importance to fruit growers. I might say that last year, when the question was raised as to meeting South, the question of the time came up. We had to arrange the time in accordance with the convenience of our hosts, The Florida Horticultural Society and the Tampa Board of Trade, and we put it ten days later than originally intended. I hope, however, that this present arrangement will result in a large attendance on the part of your Society.

The morning session was then adjourned, the Society to reconvene promptly at 2:30 p. m.

## AFTERNOON SESSION.

The afternoon session was called to order at 2:30, and the paper on the subject "Beautifying Home Surroundings" by Mr. P. J. Hjort, of Thomasville, was called for.

Mr. Hjort's son responded in his father's absence, and read his paper for him, as follows:

### BEAUTIFYING RURAL HOME SURROUNDINGS.

In taking up the question of beautifying rural home surroundings, one would naturally infer that what is meant is the making of a flower garden, planting shade trees, etc. The last half, so far as it goes, is correct. The first half does not exactly express the idea. In making a flower garden it is natural to suppose, that one would proceed to select a suitable spot, which will answer the purpose as regards location, soil, exposure and drainage. In beautifying home grounds, we are usually deprived of the advantage of selecting the location, and find ourselves confronted by conditions often adverse to the object. We have to deal with conditions as we find them, and if possible turn the obstacles into advantages. Incidental mention may be made of an unsightly sink hole on a nearby private estate, which was skillfully turned into a beautiful flight of terraces, and which is now one of the show places of the vicinity.

### OBJECTS TO BE ATTAINED.

The main objects to be attained are the screening of unsightly buildings and other objectionable features, providing the proper roads and paths, in a manner to obtain a maximum of convenience, and at the same time making the least possible display of bare dirt. The making of the ornamental parts of the grounds comes much easier after these preliminaries have been attended to.

### SCREENING.

Outbuildings are always more or less unsightly, unless dwarfed by planting something in front of them. Even if the trees set in front are only a fraction of the height of the building, they soften the outline, and produce a far different effect. For this purpose the various conifers are most suitable. The idea can be easily demonstrated, if one will only compare the looks of a place, where these details have been attended to, with one where planting for ornament has been neglected, and the latter class is, unfortunately, in the majority.

In planting of shrubs near a residence, one may plant for both openness and seclusion, by arranging the shrubs in such a manner that passers-by may see very little that transpires within, while those inside can see all the traffic on the outside. This requires some skill in arranging, but it is well worth the trouble.

### ROAD MAKING AND GRADING.

In making a drive, one should be careful to avoid ungraceful lines. A straight road will answer in many cases, and can often be made to convey an idea of a much greater distance than there really is, especially if lined with plants of a low growth, and with gray or bluish foliage.

A curved road where it matches the surrounding landscape is very pretty, provided it is true, but a curve that is not true is always an eyesore. Besides laying a curve off geometrically it is also necessary to look at it from various view points, as it sometimes needs some changes before it looks right. The road beds should be rounded some in the middle, leaving a gutter on each side, the depth of which will vary with the drainage necessary for carrying off the surplus water.

Where the general contour of the ground is on a level, all small irregularities in the surface should be graded before planting, as it is difficult to do this afterwards, without injury.

Where the land is hilly, sometimes terraces come in handy, if properly arranged, and the possibilities of beautifying are really greater on hilly land than on that which is level. It should always be borne in mind, however, that the terraces must be absolutely level; otherwise they are likely to prove troublesome, as they will wash during a rain. It is also advisable to plant a low hedge on the crest of a terrace, where conditions allow it, as they help to keep the soil in place.

### NATURAL LANDSCAPES.

Natural landscapes possess all the essential features sought by the landscape gardener. One can learn many a lesson by studying the arrangement of low growing shrubs in front of a piece of woodland. This leads us to see the advantage in planting objects of a lower growth in front of taller trees or shrubs.

The masses of trees, the single specimens, the flower beds, the wide expanse of green grass, even the low border defining the path made by man or beast, all the features are found in the wild landscape. Some features thus found are well worth imitating.

### RULES.

There are certain rules laid down for laying out grounds, but the rules of different authorities vary so much that it is pretty much a matter of individual taste how the grounds are planned. On a few points the authorities agree, for instance, that the shortest distance between any two given points is a straight line. That it is not in good taste to dot your shrubs all over the grass, because it makes the lawn look smaller, and the perspective is lost. That it is not advisable to mix evergreens and deciduous plants in the same cluster, because the evergreens will look bare in the winter, where they have been in contact with the others.

### HEDGES.

One idea, which seems to be universal among modern landscape men is, that hedges have no place in the landscape. Still, there are very few of the possessors of beautiful hedges who would willingly abandon them simply

because they are not fashionable. A hedge is nearly always appropriate as a means of defining the boundary between the flower garden, near the residence, and the outlying grounds, which should be planned to some extent in conformity to nature, and therefore do not readily absorb the artificial garden near the residence as an integral part. In planning a hedge, it is well before choosing the material to study the conditions of the locality, as well as the purpose. There are various plants that make good hedges, the most commonly used here being Amoor privet. This answers admirably for a hedge anywhere from six inches to ten feet in height, and will make a hedge in less time than any other plant known. Where the white fly is plentiful, it may be best, however, to use something else. Some of the privets are more resistant than the Amoor. If the soil is heavy clay, a low hedge can be made of boxwood and a taller one of arbor vita, especially the common Chinese. Many of the flowering shrubs also make good hedges, especially *Spirea Thunbergii* and *Cydonia Japonica*.

#### FLOWER BORDERS.

The flower border is always appropriate where a walk can be arranged parallel with a line of shrubbery, and may be made into a catch all for quite a collection of things that the owner may take a fancy to. The flower border can be made to bloom nearly the whole year by properly selecting the material for it. Hardy herbaceous stuff is not used here to the same extent to which it is planted at the North, but this is because we are beginners here, at least in a manner. It will, perhaps, be a surprise to some of those present here to know, that nearly half of the species of herbaceous plants sold in this country are indigenous to the Southern States. Many of these are capable of further improvement.

The greater part of the annual plants, which are available for borders, are all but unknown here, but are gradually coming into use.

- Cannas, Dahlias, etc., might properly be classed as hardy herbaceous stuff here, as they can be safely left in the ground during the winter, and form excellent border plants, which need to be transplanted only when they become crowded. This applies also to certain Holland bulbs, especially *Narcissus* of the *Polyanthus* class, and the jonquils. *Hyacinths* usually deteriorate in a couple of years, and so do the daffodils. Tulips are not generally successful here, but the late May flowering kinds will thrive under certain conditions.

Many flowering shrubs of a low-growing character are appropriate for borders. Among these the *Azalea* comes first, and is largely used for this purpose in places around Thomasville, especially the last few years. They are used by the acre, where they were formerly used by the dozen. The evergreen Indian *Azalea* is the most useful here, as the deciduous kinds are not entirely successful with us. We have, however, repeatedly used *Azalea mollis* as a bedding plant, with the understanding that we would throw them away after the blooming season, as they are low priced and very effective. A border may be appropriately lined with *Santolina chamaecyparissus*, which with its gray leaves, gives an idea of distance, especially to a straight border.

## SHRUBBERY.

In this class there is such a bewildering mass of material available for beautifying grounds here, that a list would be tedious, and as lists of the better known ones have been so often given, we will only mention a few of the less known kinds of real merit.

Among the coniferous class of trees and shrubs one of the very best is the *Cunninghamia sinensis*, which forms an excellent single specimen on a lawn, and takes the place of the *araucaria*, which does not succeed with us. Of the *Cupressus lawsoniana* there are numerous garden forms, comparatively little known in this country, although well known in Europe, where they are much admired. Almost all of these cypresses do well with us.

In broad leaved evergreens the *Ternstroemia japonica* deserves to be mentioned, as it forms a beautiful compact shrub, and does finely with us, but is, so far, the only *Phillyrea* that has proven successful.

## JAPANESE PLANTS.

It is a well known fact that a large proportion of our ornamentals come from Japan. It is not so well known, perhaps, that the Japanese species of the same class are of a lower and more compact growth than the American species. This fact is well worth considering when making a selection for any special purpose. For instance, you would choose the *Cercis canadensis*, or American Judas tree, for a distant effect, or where a tall tree is required, but the *Cercis chinensis* for a near-by point, where a lower, more compact tree is required.

The Japanese wistarias are better suited to this locality than the American kinds.

## VINES.

Where nothing else will answer the purpose, a good effect can be had with vines and climbers, as they will climb poles, trellises, chimneys, wires, fences, or anything, or crawl on the ground. Of course, they are not all adapted to the same purpose, the wistaria looks best overhead, with the flowers hanging down, while the *vinca*, or ground myrtle, hugs the ground, with its flowers erect. The native yellow jessamine will do either way, going or coming.

In conclusion allow me to say that no amount of improvement will be successful, unless the work is kept up afterwards.

With proper attention the grounds once beautified will increase in attractiveness as the years pass, and prove a constant source of pleasure.

**CHAIRMAN HUNT:** The next paper on the program is an address by Mr. E. L. Worsham, State Entomologist.

**MR. LEWIS:** Mr. Worsham, as you know, left last night, and the article that Mr. Worsham was to read was on "Spraying Apparatus for Scale Insects." It struck me that, as there are not many, and as those who

are here know all about spraying apparatus, that it might be well to read the title of the paper, and pass it to the Secretary to be embraced in the proceedings. Later on, upon the opening of the question box, I might make a little talk on blight.

#### SPRAYING APPARATUS FOR SCALE INSECTS.

By E. L. WORSHAM, State Entomologist of Georgia.

The title of this paper designates a consideration of spraying apparatus and accessories particularly with reference to their use in controlling Coccidæ. Generally speaking, any good modern pump is equally well adapted to spraying both fungicides and insecticides. In certain respects, however, which are primarily concerned with the physical nature of the spray material, the efficiency of the various types of spray pumps is somewhat variable. The reason for this variation is hereinafter discussed more fully under the head of pump construction. There is spraying apparatus of all kinds and sizes, and the selection of an outfit is, therefore, based on its service requirements. Beginning with the smallest of all, the bucket pumps which may be had for a few dollars, the sizes and costs will increase on a more or less graduated scale up to the 200 gallon power pumps which cost several hundred dollars.

Strong competition in the spray machinery business is responsible for the rapid improvement in the construction of pumps and accessories. It is now possible for the purchaser to obtain good, durable and efficient pumps from a number of manufacturers and at a cost entirely commensurate with their value. Individual operators have a large field in which to exercise their choice, though such choice would necessarily be founded more upon some peculiar mechanical device than upon cost.

#### BUCKET AND KNAPSACK PUMPS.

These two styles are grouped together because their field of usefulness is so limited. With sufficiently long leads of hose they may be used on small orchard trees, but they are designed and built ostensibly for use in spraying green house plants and shrubs. Their relatively small cost places them easily within the reach of all who have ornamental plants to protect, both indoors and out, from scale insects, and in this field they make valuable acquisitions to the garden, the green house, and in the growing of small ornamental plants.

The bucket pump as a rule is constructed so as to extend into the bucket, to which it is attached by a clamp; a foot piece extends to the ground and by placing the foot upon this, the pump is held in position while it is being worked. The cost varies from five to ten dollars.

The Knapsack pump, being more portable and somewhat larger, is a more desirable contrivance for use in the sphere above assigned to the bucket pump. It is attached to the back after the fashion of a knapsack, and is worked by a lever extending over the operator's shoulder. The

details of construction vary between the different manufacturers, but the general plan is much the same in all. They are of five gallon capacity, and are fitted with 3-8 inch hose, to which any style nozzle may be fitted. The tanks are made of brass or galvanized iron, and the prices are governed by the metal used in their make up. The listed prices vary from ten to eighteen dollars.

#### BARREL PUMPS.

Barrel pumps, as the name denotes, are pumps intended for mounting in barrels, and their size, cheapness, and general efficiency for spraying on both large and small scale renders them, perhaps, the most important type of spray pump. When fitted out with good accessories, they are capable of spraying the largest fruit trees under ordinary conditions and by far the larger part of all orchard spraying is done with pumps of this class. Practically the same principals are incorporated in the manufacture of the different makes, though the details of construction vary greatly. It may be well in discussing this pump to consider what the essentials of a good pump are.

To begin with it is necessary to have an air chamber to insure a steady, consistent spray, otherwise the spray would be intermittent and pulsating. This air chamber part may be either separated from the working parts of the pump or combined with them. In some styles it is on top of the barrel, but in the more satisfactory types it is within, and in the latter the stability of the pump is greater. A large air chamber on the top of the barrel renders it top heavy, and this top heaviness is likely to become responsible for accidents in spraying on rough land.

One feature of the barrel pump that is yet far from perfection is the agitator. In most forms the paddle agitator is used, but these, while they are all that could be desired for spraying materials free from solid matter, will not and cannot keep sprays such as the home-made lime and sulphur thoroughly mixed. The tips of the paddles describe an arc of about 45 degrees and work so slowly that the lime quickly settles to the bottom with the result that the first part of the material as it comes from the barrel carries much more free lime than the last, which has but little.

The question of the agitator for barrel pumps is an important one and one that has not heretofore been solved. It is only in gas power sprays that this feature is perfected. However, for the materials now being used against scale insects which are uniform in composition, and carry no solids, an agitator is wholly unnecessary.

The working parts of a pump, namely, the valves, valve seats, plunger and cylinder, should be made of metal resistant to the corrosive action of the spray material. These are usually of brass, bronze, or porcelain substances, not corroded by the action of the liquid.

A pump should be compactly built with all the working parts closely fitted so as to prevent leakage and attendant loss of power. All parts should be easily removable for cleaning purposes and to make repairs. Much trouble may be avoided by using only the best packing for the plunger. The standard asbestos is far superior to leather or cord, being

more resistant to the caustic action of the spray and in every way more durable and satisfactory.

The spray pump market supplies a large number of different makes of barrel pumps. Those best known to the author are the "Deming," manufactured at Salem, Ohio; the "Friend," manufactured at Carport, N. Y.; the "Gould," at Seneca Falls, N. Y.; the "Bean," at Cleveland, Ohio, and the "Hardie," at Hudson, Mich. The last has the pump mounted in the side of the barrel instead of the top, and this feature makes it particularly adaptable for spraying on rough steep hillsides. By building a framework to the front trucks of a wagon and attaching the barrel thereto, the pump may be operated by the driver from the ground. The frame work being a continuation of the shafts, gives the barrel an angle which brings the pump handle to a position from which it can easily be worked by the driver. The pump when so arranged is especially valuable for use on land not really accessible to a wagon.

Any of the above named are good, reliable makes, and with proper care will last indefinitely. They are sufficiently powerful to generate and consistently maintain pressure for the two leads of hose carrying a total of four nozzles.

#### HORIZONTAL PUMPS.

This type of pump is designed for spraying on an extensive scale. It is larger and more powerful than the barrel pumps, and is capable of supplying four leads of hose. The air chamber is of greater capacity and therefore capable of storing more air pressure than the smaller types. The plungers are usually differential and thus an equal pressure is exerted on both strokes, making the pumps double acting. With these, as with the barrel pumps, the principal of construction is practically the same. There are many differences in detail, and it is in the details that each manufacturer claims superiority over his competitor.

Horizontal pumps are intended for attaching to wagon tanks of from 100 to 200 gallons capacity. They may also be bolted to a heavy lead and operated in connection with an ordinary fifty gallon barrel. Primarily, however, they are designed for tanks and for heavy work on a large scale.

This style of pump may be, and usually is, operated by hand, but they are also usually fitted up with a pitman or similar device for connecting to a gas engine. The Bean Pump Co., manufacture a pump of this kind that includes a heavy coil spring for equalizing the efforts necessary to operate the pump handle. On one strike energy is stored into the spring by the pull against its resistance and the resultant compression, and in the return stroke the stored energy contained in the compressed spring is released and the expansion helps the operator in forcing the liquid into the air chamber against guage pressure.

The working parts of the horizontal pumps are not immersed in the spray material as is the case with most pumps of smaller size. The air chamber is connected to the material supply by a piece of heavy rubber piping, and is filled by suction. Repairs are much easier effected than with barrel pumps, which have to be removed from the barrels, sometimes when

the latter are full of spray material, before the seat of the trouble can be reached.

The cost of the horizontal pump ranges from twenty-five to fifty dollars. Nearly all the pump manufacturers have their cheaper and their better grades with an accompanying price list to match.

#### POWER PUMPS.

Power pumps are of two kinds, (1) gasoline and (2) compressed air or compressed gas. With these machines it is possible to maintain the air pressure at a higher and more constant figure than with hand motive power. The maximum degree of successful spraying against scale insects is obtained only when the spray is driven onto them in a finely divided state and with force. The greater the force the greater the efficiency of the work, all other conditions being equal. Power outfits meet this essential requirement better than those operated by hand for the reason that they can maintain a higher pressure and hold it practically constant. For general efficiency and labor saving they are superior to other types, especially in large commercial orchards, parks, etc.

#### GASOLINE POWER PUMPS.

All the leading power pump manufacturers turn out regular power pump outfits, and they are giving general satisfaction, wherever used. The original purchase price is, of course, much higher than for hand pumps, but thereafter they may be operated at a smaller cost and the additional cost in the beginning represents economy in the end.

Power pumps can constantly maintain high pressure for four leads of hose and have a capacity of two hundred gallons per hour. Their greater weight makes them ineligible for use on land of a rough or hilly nature, but on flat land they are the most efficient and most rapid sprayers on the market, their value as time and money savers being more generally understood and appreciated than ever before. They are cheaper, too, than at any time in the past. A spraying outfit with gas engine, pump, lead, hose, etc., may be bought for sums varying from \$135.00 to \$300.00. The gasoline engines may be used for other farm purposes as well.

One feature of the gasoline outfits wherein they outclass any other type of pump is the matter of the agitator. By attaching the agitator to the engine the paddles may be run at a rapid rate of speed and the spray material kept in a violent state of agitation. When home made lime and sulphur or other materials carrying solid matter are used, this form of power pump is superior to any other.

#### COMPRESSED AIR PUMPS.

This class of pump is of two kinds, i. e., those that are air charged at a fixed station, and those that compress the air into a cylinder by means of an apparatus connected with the rear wheels of the spray wagon. Both of these types are worthy of recommendation under certain conditions. Where no part of the spray solution will settle out, as when miscible oils, prepared lime and sulphur, etc., are used, and no agitation thereof is necessary, pumps that are air charged at the renewal station are highly

efficient. Pumps that depend on the automatic compression of the air from the turning of the wagon wheels are efficient only when the trees are small and can be rapidly sprayed. They are failures among large trees that require some minutes to spray before an advance is made. Neither of these types have adequate agitation equipment, and other means must be employed wherever necessary to keep the material well mixed.

#### CARBONIC ACID GAS PUMPS.

The working principles of carbonic acid gas pumps is almost identically like the compressed air type, except that the cylinder is charged with carbonic acid gas instead of air. It is an efficient, serviceable pump, but with respect to the agitator it is equally as inefficient as the compressed air pumps.

#### SPRAYING ACCESSORIES.

No pump, no matter how capable, will give service without the complementary support of good spraying auxiliaries of the best quality and design. As much attention should be given to these as the pump itself. These accessories consist of hose, extension rod, stop cocks, and nozzles.

#### HOSE.

Nothing need be said of this save that it should be of the best quality and ample length. As a matter of economy, it is cheaper to buy the best grade four ply goods. This will easily last a full season or longer with proper care. Cheaper grades are quick to leak and are generally unsatisfactory. The better grades of hose cannot be bought for less than fifteen cents per foot.

#### EXTENSION RODS.

No spraying outfit is complete without an extension rod. It is an indispensable adjunct in reaching to all parts of the trees, expediting the work and improving the quality of the spraying. Besides the advantages, it is a protection to the operator, enabling him to evade a wetting from the spray mists as it is blown or drifted about. Rods are usually made of 1-4 inch piping and are cut to any desired length based upon the requirements. Bamboo rods are also used for the same purpose. Piping may be cut in short lengths and lengthened or shortened at will to suit the occasion, by means of couplings.

#### STOP COCKS.

Stop cocks are very serviceable and almost imperatively necessary in large spraying operations. By cutting off the flow they prevent waste in moving from tree to tree, and are invaluable to successful and economical spraying. There are only a few types, the best of which is the brass stop cock with stuffing box that may be tightened so as to prevent all leakage. This type has a cut off handle two inches long extending on just one side of the stuffing box and readily cut on or off by the thumb.

#### NOZZLES.

There are nozzles of all kinds and sizes and one must be governed by the requirements in each case. In spraying for scale insects it is of prime importance to use only nozzles throwing a finely divided spray. Maximum good results are obtained from nozzles insuring this important feature.

The best types of nozzles used in Georgia are the Vermorel, Bean, Friend and Mistry, Jr. These may be attached to the rod singly, in couples, or sets of three or more. In the writer's opinion the best nozzle now on the market is what is called the Mistry, Jr.

The Bean Manufacturing Co., also makes similar nozzles. In this type the construction is exceedingly simple; they do not easily become obstructed. They are without the degorger common to the Vermorel type, and the objectionable feature occasioned by the catching of these prongs on the limbs, pulling off the fruit, etc., are eliminated. Their extreme simplicity, the ease with which they are cleaned, and the rapid and thorough work they insure puts them well at the head of the lists in the world of nozzles.

CHAIRMAN HUNT: Prof. Soule is absent with his "College on Wheels" to-day. So, as we cannot have his address, I think we had better open up that question box, and give Mr. Lewis an opportunity to give us some ideas about pear and apple blight.

MR. BERCKMANS: This morning in the course of the discussion in regard to pear blight, I suggested that the Department had been carrying on some very interesting experiments with pear blight in McDuffie county in Mr. West's orchard. I believe these experiments have been carried on for five or six years, and as Mr. Lewis has recently made a trip down there, and investigated it, I am sure he will be able to throw some light on this subject.

MR. LEWIS: I can state in a brief way what we have found out. I might say what we have learned from our experience. When I came here, as you may know, in 1905, Prof. Orton was working on Mr. Wight's place on pears. At the same time we started to work in Mr. West's orchard at Thomson, 35 miles this side of Augusta. To make the work cover the State, we also took in one orchard at Calhoun, but we only worked in the orchard in North Georgia for one year, because the owner became so disgusted that he cut the whole thing down.

I believe that Mr. Wight spoke this morning some-

thing that we have proven conclusively, that is, that pruning, to be effective for blight, must be extended over a large territory; in other words not only one man, but all in the section must prune; that's the secret of the whole thing. In Thomson we have an isolated orchard; there's not a pear tree within a mile of it, and we have been pruning that orchard to the best of our ability so far as the time would permit for five years, and we have not yet completely eradicated the blight, but we have reduced it to such an extent that you would hardly know it was the same orchard that it was five years ago, when we took hold of it.

When we took hold of that orchard, the trees were from 10 to 15 feet high, and after we had pruned it, people coming along the road would say, "Why didn't you cut it down to the ground?" We had to do that in order to reform the trees, make them all over new as best we could, considering the condition they were in. Last year there was a fine pear crop on that orchard, but there was some blight, although not enough to do any great amount of damage.

We have been trying mainly to instruct the growers, so they can do their own pruning. We cannot go over the state, or even take three or four or a half dozen orchards, and prune systematically; so our main effort has been to instruct the grower, so he can prune his orchard in the proper way. The proper way to prune an orchard for pear blight is to go through in the winter, and cut out every bit of blight that you can find; do this any time in the winter, say whenever it comes handy, being careful to use a disinfectant, such as corrosive sublimate, and remove as far as possible all blighted twigs, or all live or hold-over blight you can find at that

time. The blight winters over on the tree in spots—we call it live blight, or hold-over blight; sometimes it is in cankered form. You won't find this on little twigs, but on the large limbs and on the trunk. The trouble is with most people, they will go through to prune for blight and they will cut out all the little twigs they can easily see, and will leave this hold-over blight on the larger parts of the tree. To show you that's the case, over here in Thomson the man wrote me two weeks ago that he was now going through the orchard and pruning it. When I walked through I showed him three trees full of hold-over blight, two of which had to be cut down entirely in order to get rid of the blight on them, and the other tree had to have half of it taken away.

The looks of the bark will tell you when the blight is alive. It may start in on a little twig, or the end of a limb, and it will run on down the limb until it gets to a crotch, and then it will continue on down the larger limb, and you might cut off some of the larger limb and think you have it all, but, if you will cut the bark open further down, you will find that it is red and discolored, but not dead. That's the live hold-over blight. In the spring, when the sap begins to come up in the tree, it will break through the bark and the sap will ooze out of the tree, and insects come and get in that sap, thence to the bloom, and inoculate the bloom with blight.

So the idea is to remove all this blight that you can possibly get out in the winter, and then go over again in the spring just as late as you can before the blooms open, and cut out what you find then. You may go through in the winter, when the tree is dormant, and you may think you have removed all the blight, and then go over again in the spring, and you will find discolored

spots that you didn't observe before. Those are the very ones that must be gotten out before the tree blooms.

In one case last week near Thomson we found a tree that had the most beautiful top of any tree in the orchard; there was not a sign of blight on the tree; every limb looked as pretty and clean as could be. But we looked right in the forks of the branches; and in there it was just literally filled with blight. It had started on a little fruit spur, run into that large limb, and run down to the trunk, which was as big around as a post; we cut that bark, and clear down to the ground it was discolored. That's what you have to consider, and that's why it has been such a great problem to get the growers to remove all the blight.

At the same time, we started at Smithville a fertilizer experiment to see what effect fertilizers would have on blight. We had a very complete test, and we carried it on until we killed so many trees that the grower didn't want us to continue longer, because the trees on which we used certain fertilizers nearly always died. I couldn't give you the formulas that we used, but we had seven different plats for the use of the seven different kinds of fertilizers. On some we had just acid alone, on one potash alone; then we combined the acid and potash together; and then again we used acid and potash and nitrate of soda; and where we used nitrate of soda, about the third year, the men had to go to cutting down trees.

Spraying has been used by some to control blight. You can't exterminate blight by spraying; you can't kill it; you can't control it, but if you will spray as late as possible in the spring, just before the blooms open, with lime and sulphur, home made, you will seal it up, as it were, so that the insects won't carry the blight so quickly to the bloom.

That's the sum and substance of what we have found out about blight. Be systematic and cut it out, and don't use much fertilizer, don't make your trees grow any more than you have to to make them set fruit.

There's an orchard near Augusta set in Bermuda grass that has borne fruit for the last five or six years, and had very little blight. I believe if it would be practicable, that it would be a good idea to put on a little fertilizer, just enough to make them grow, so that they would set fruit, and put them down in sod. That's the best way, I believe, to treat your orchard, because the orchard I mentioned is about as free of blight as any orchard I ever saw.

EX-GOVERNOR HOARD: You spoke of corrosive sublimate. How do you use it?

MR. LEWIS: Just use it as a disinfectant to put on the cut surface.

GOV. HOARD: How far below the disease do you cut off the limbs?

MR. LEWIS: Well, on some trees in six inches you can remove all of it—and be sure you get all of it, of course without making too large a wound—but if it goes more than half way around the tree, take the axe to it, and chop it down.

GOV. HOARD: What's your process when you do remove the bark?

MR. LEWIS: Disinfect with corrosive sublimate and paint it. We have trees over at Thomson, where we removed almost half of the tree, and I noticed the other day that they have all healed up and are in very good condition now, but in nearly every case, where we had to do so much surgical work on a tree, the blight would get in again sometime during the summer.

Gov. HOARD: Does this blight prevail as much in strong limestone soils as it does in others?

MR. LEWIS: Well, up here at Americus, and down south of there a few miles, they have what they call lime sinks, and still blight is very bad there.

COL. WADE: I lived in a limestone section of Virginia, and the trees there were all pretty nearly ruined with blight, but they have not had it since about 14 or 15 years ago.

COL. FORT: I planted out three orchards 23 years ago. I have it and I am satisfied that you can't get rid of the blight. I make a very fair return on my orchards, notwithstanding the blight. I have one orchard set in Bermuda grass—that's one of my best orchards—and its on strong limestone land. You will have to find some new remedy for blight. I am satisfied it can't be controlled with Bordeaux mixture.

MRS. LEWIS: Nearly anybody can go in a pear orchard, and see these little twigs dead for six inches or even for a foot or two, and they cut all of those out, but they don't think of looking down on the trunk or on those large limbs, where it does not show so much, but just a discoloration of the bark. That's where the live or hold-over blight stays in the winter.

Now another thing I want to call attention to is this: when a limb is cut out, it should not be allowed to lay on the ground there for two weeks before it is removed from the orchard. It ought to be burned just as soon as possible, so as to stop the infection.

PROF. McHATTON: Corrosive sublimate is hard on the tools, have you ever tried chloride of lime?

MR. LEWIS: Lately I have begun to recommend formaldehyde, about a 4 per cent. solution.

PROF. McHATTON: I am interested in this blight business from the work that we have been carrying on at the college. I believe one of the greatest ways we have of fighting blight is to start the young orchard right. The natural habit of the pear tree is to grow to a pyramid, and if we will prune out so as to make those trees grow away from the pyramid shape, we will have enough so that we can cut out those infected limbs, and still have enough to make a crop of pears. I am pruning the orchard now with open top.

COL. FORT: I can get returns from my orchards, notwithstanding the blight. It will pay me \$100 an acre.

MR. LEWIS: It would seem almost impossible to control blight where your neighbor does not prune for blight. I think it will have to be carried on like it is in California, by counties and sections.

COL. FORT: We have got to learn something about it.

MR. LEWIS: We know enough about it, if we could put into operation all that we know.

MR. BLACK: Do you think it is dangerous to use cowpeas in your apple orchard for the improvement of the soil?

MR. LEWIS: No, I don't think there would be any danger unless you had the ground so rich that it would make them grow very rapidly and sap it. Generally in this section, I don't think they would need cowpeas. I think there is not much danger in Habersham and Rabun counties, as the Nematode worm is not present in the soil.

That pruning system for the open head is one of the great secrets. I don't think though, that we can hope to successfully control blight until the growers will co-oper-

ate with those who want to fight it, and make it a state-wide movement.

COL. WADE (occupying the chair): The next paper was to have been presented by President Soule, but as he is with the College on Wheels, we cannot have that, and so far as the regular program of the Society is concerned, it is finished. We have now on hand the report of the Committee on Resolutions, place of meeting, and the election of officers.

MR. R. C. BERCKMANS: Mr. Chairman, I would suggest, in view of the fact that we want to get as many together as possible at our next annual meeting of our people interested in horticulture, agriculture and dairying, and probably those interested in conservation, that we consider the advisability of holding a joint session in Athens in January, of the dairymen, agriculturists and horticulturists, and conservationists, holding a two days session, and dividing each day into three parts, three sessions, and having the different organizations alternate in control of the different sessions. I offer this as a suggestion, and would like to hear it discussed. Probably it might be advisable for you to appoint a Committee to look into that matter. In fact, I will make that as a motion.

Prof. McHatton, in seconding this motion, spoke in its behalf, and at the conclusion of his remarks, the Chairman asked:

“How would it suit you to have the newly elected officers of this Association to confer with the officers of these other Associations, and if it is satisfactory to them, leave the final arrangements for the joint session to them?”

MR. BERCKMANS: That's good. I am willing to amend the motion I made to that effect.

The motion was then put to vote and carried.

COL. WADE: Next we will have the report of the Committee on Fruits.

PROF. MCHATTON: We usually have a report of various displays that are on hand at our meetings. This year the display was not as extensive as it might have been in one sense of the word, but to a thinking man it is a very comprehensive display of what can be done in Georgia. We have displayed this year some oranges from Grady county, Georgia, and we had side by side with them some apples from Habersham county. I only call to mind now one state that can do that, and that's California, and that's over here on the other side. We have the extremes. This is a good orange. I ate one of them and this exhibit was one of eight oranges in one cluster. These apples are a specially delightful fruit. These apples were raised at 1800 feet altitude, and these oranges practically at sea level. That brings the two extremes together. Think of the horticultural possibilities, gentlemen, that we have in this State. Why, it's not going to be long before Central Georgia will be raising oranges. They raise fine apples out West and up North, but they never have raised any finer apples than we have in Georgia.

I would like also to mention the fact that we have at this meeting of the Society some flowers, which are, as far as I know, the prettiest flowers that we have had at any meeting for the past three or four years, and we are just passing into February. I mainly wanted to impress that one point, Mr. Chairman, that here we have in this display an example of the two extremes brought together

in one State, and there's only one other State that I know of, that can do it, and that's several thousand miles from the markets that we serve. (Applause.)

COL. WADE: We will next hear from the Committee on Resolutions.

The following resolutions were offered by the Committee on Resolutions.

WHEREAS, on November 8, 1910, Prosper Julius Alphonso Berckmans died at Fruitlands, his home near Augusta, Ga.

This great man was born in Belgium on the 13th of October, 1830. In 1850 he came to the United States; adopted this country and became a citizen in 1854. In 1859 he established the Fruitland Nurseries, the greatest in the South, and from that time on became a prominent figure in the horticulture of this section, as well as in that of the United States; and,

WHEREAS: Recognizing his worth several of the French Societies made him a corresponding member. He was also a corresponding member of the Massachusetts Horticultural Society, an honorary member of the Florida Horticultural Society, the Nebraska Horticultural Society, and the Alabama Horticultural Society, President of the American Pomological Society for ten years, resigning in 1897, and President of the Georgia Horticultural Society from its birth in 1876 until the present time.

To him the United States owes the introduction of numerous plants of commercial importance, as well as that of many of decorative value.

THEREFORE, BE IT RESOLVED, By the Georgia Horticultural Society in session assembled at Thomasville, on the 7th and 8th of February, 1911:

That the death of their President, Prosper Julius Alphonso Berckmans, was a great loss to this Society. We mourn his death.

We knew him to be a constructor of Southern prosperity;

We recognized in him an authority on all subjects pertaining to horticulture;

We esteemed him as a true friend, a scholar and a gentleman;

The State of Georgia has lost a constructive and exemplary citizen; the horticultural interests of the United States have suffered an irreparable loss;

BE IT FURTHER RESOLVED: That the Society extend their sympathy to the members of the bereaved family, and that a copy of these resolutions be sent to Mrs. Berckmans and other members of the family, as well as spread upon the minutes of the Society.

RESOLVED: That inasmuch as we, as horticulturists, are constantly sending and receiving samples of plants, fruits and small trees, by Express at large expense; therefore, we heartily recommend the extension of the parcels post system throughout this country.

RESOLVED: That we urge and insist upon the strengthening of our laws, protecting the orchardists from the ravages of diseases caught from trees

now being shipped throughout the State, by careless or unscrupulous tree peddlers or nurserymen or the neglect of our neighbors.

**RESOLVED:** That we continue our efforts until we get our just demands of a minimum car of 18,000 lbs.

**RESOLVED:** That we send a copy of these Resolutions to our Representatives, Senators in Congress and Members of the Legislature.

We desire to express our appreciation and thanks to the good people of Thomasville, for the kindness and hospitality shown us during our stay in the City.

We also desire to express our thanks and appreciation of the beautiful flowers furnished by the ladies in decorating the room during our sessions.

The report of the Committee on Resolutions was adopted as a whole, after each and every resolution had been adopted separately as read.

Upon the call, by the Chair, for the nomination of officers, the following gentlemen were elected officers of the Society for the ensuing year by rising vote:

Mr. Robert C. Berckmans, of Augusta, President.

Mr. B. W. Hunt, of Eatonton, Vice-President.

Mr. J. B. Wight, of Cairo, Secretary.

Dr. T. H. McHatton, of Athens, Treasurer.

The gavel was then presented to Mr. R. C. Berckmans, the newly elected President, who stated:

“Gentlemen, Co-laborers and Friends of the Georgia Horticultural Society: Words fail me to express to you my deep gratitude for this high position, in which you have placed me. Not only do I thank you for the honor, but I express to you my deep appreciation of your kindness in placing me in this position to succeed my honored father who has been your leader since your organization.

All I ask you to do is to stand by me, and put your shoulder to the wheel, and let's make this one of the greatest organizations in the entire South, and we can make it one of the greatest in the entire land, if we conduct it not only on a business basis, but on a scientific

basis, and it rests with you to assist me in bringing about a development of this great industry.

I thank you very much for your kindness, and the trust which you have reposed in me. (Applause).

SECRETARY WIGHT: In addition to our list of regular members, Mr. President, we have a list of honorary members, and a very honorable list it is and from time to time we add to this list such men as have distinguished themselves along the lines that we are working on. I think a distinct addition to this list would be the name of Ex-Governor Hoard, of Wisconsin, and I therefore propose his name for honorary membership.

This motion was seconded by Col. I. C. Wade, of Cornelia, and was carried by rising vote.

Ex-Governor Hoard expressed his deep appreciation of this action on the part of the Society.

PROF. MCHATTON: I move that the appointment of the District Vice-Presidents be left with the President.

This motion was seconded and carried.

On motion the meeting was then adjourned.

Statement of L. A. Berckmans, Treasurer,  
Georgia State Horticultural Society, from January 31st, 1910,  
to January 1st, 1911.

#### RECEIPTS.

To balance brought over from 1909.....	\$161.26	
Annual dues from members.....	72.00	\$233.26

#### EXPENDITURES.

January 10, '10. Freight on proceedings.....	..\$ .25	
January 12, '10. Postage .....	3.94	
January 22, '10. Ribbons for badges from J. B. White Co	3.70	
January 26, '10. L. A. Berckmans (expense to Sparta) ..	5.06	
January 31, '10. C. J. Skinner (for reporting).....	37.81	
February 9, '10. Augusta Chronicle (for printing).....	18.00	
February 22, '10. Postage .....	3.00	
Sept. 19, '10. Freight on proceedings.....	.25	72.01
Balance on hand January 1, 1911.....		\$161.25















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